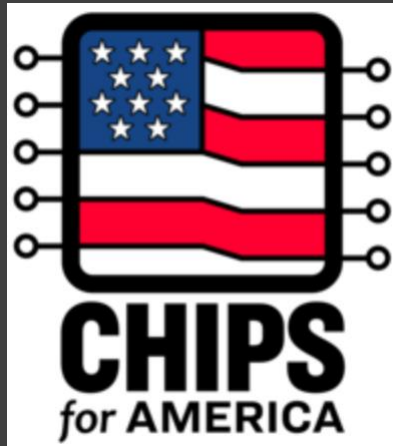


What You Need to Know About the CHIPS & Science Act

Bob Colwell

August, 2023

MODSIM '23



I'm from the government and
I'm here to help...



Whiplash...

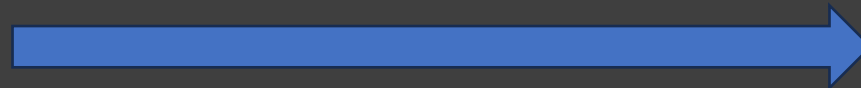
- My DARPA experience

Congressional staffer (2012): “we get asked every day for financial help for some failing industry. Yet here you are, proposing to invest US taxpayer \$\$ in new computer technology, the biggest success story of all...it’s hard to justify...”

...now it’s ten years later...Presenting:

The \$50B+ CHIPS and Science Act of 2022

What changed?



China's Got a New Plan to Overtake the US in Tech

It's in data centers that a considerable chunk of the new infrastructure development will take place.

Bloomberg | May 21, 2020

<https://www.datacenterknowledge.com/asia-pacific/china-s-got-new-plan-overtake-us-tech>

“In the masterplan backed by President Xi Jinping himself, China will invest an estimated \$1.4 trillion over six years to 2025”

“Nothing like this has happened before, this is China's gambit to win the global tech race...”

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China Will Soon Lead the U.S. in Tech

Beijing pulls ahead in 5G and artificial intelligence, while catching up in semiconductors.

By Graham Allison and Eric Schmidt
Dec. 7, 2021 6:26 pm ET

“If the US must rely on others for the development and production of defense technologies, then its military can only be as technologically advanced as its suppliers...”

“China is the most important geopolitical threat we face in the 21st century...the main arena for competition and rivalry...will be advanced technologies...”

ITIF | INFORMATION TECHNOLOGY & INNOVATION FOUNDATION

CENTERS ISSUES REGIONS PUBLICATIONS EVENTS NEWS ABOUT

Wake Up, America: China Is Overtaking the United States in Innovation Capacity

By [Ian Clay](#) and [Robert D. Atkinson](#) | January 23, 2023

[Downloads](#) [April 27 Industrial Policy Conference](#)

Based on key indicators of innovation and advanced-industry performance, China has surpassed the United States in total innovation output and is getting close on a proportional basis. To regain its leadership, the United States must respond more strategically and forcefully.

<https://itif.org/publications/2023/01/23/wake-up-america-china-is-overtaking-the-united-states-in-innovation-capacity/>

Serious Problem

Intel Investing \$20B In Arizona Semiconductor Manufacturing Expansion



Bechtel Wins Phase 1 Contract for \$20B Intel Chip Plant Project

By James Leggate



Biden hails IBM's \$20B project

Helping give U.S. a tech edge over China among objectives by AAMER MADHANI The Associated Press | October 15, 2022



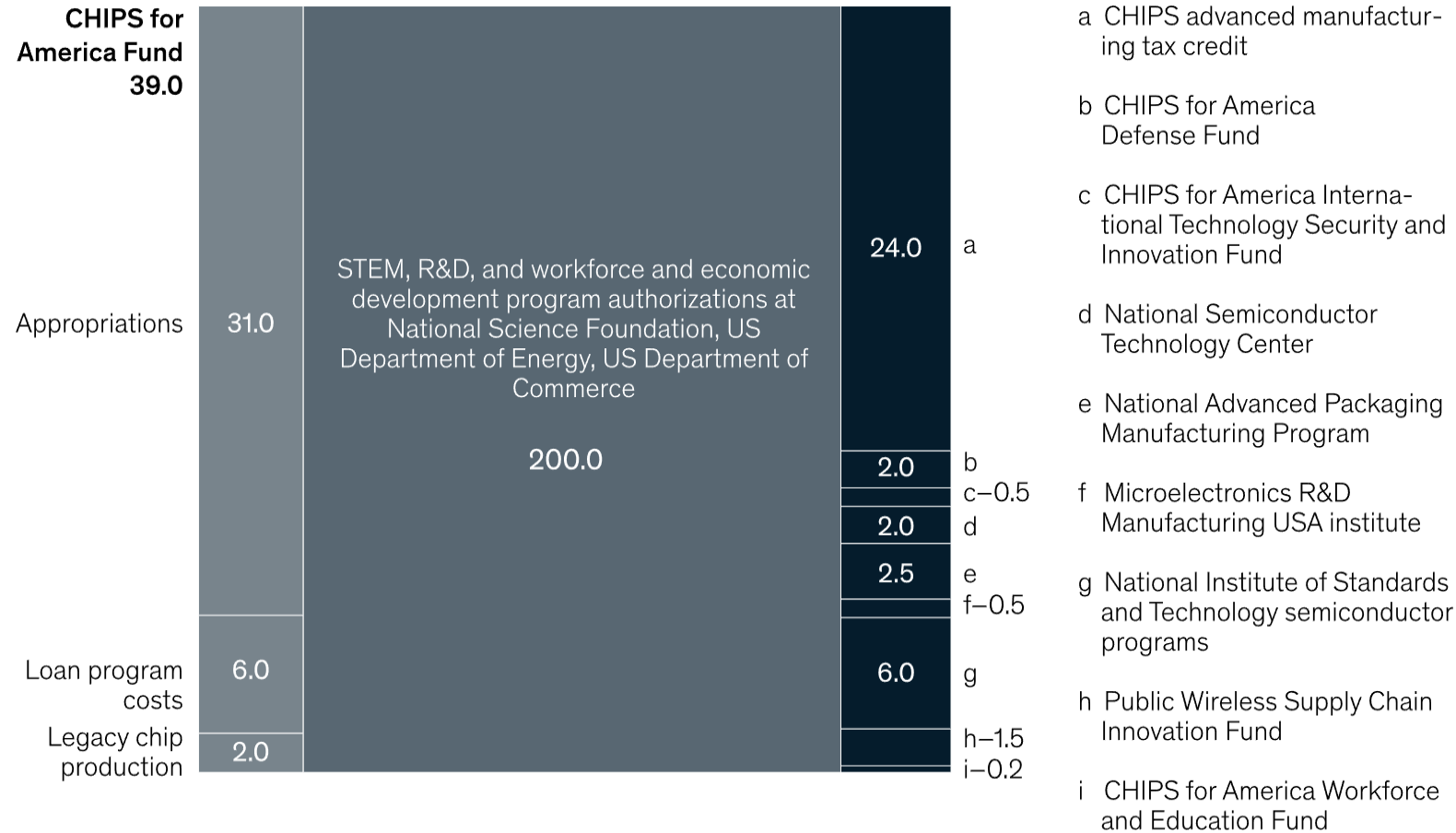
- Semiconductors are fundamental to all other industries
 - demand is astronomical and rising fast
 - > \$500B in 2022 worldwide
 - essential to 10's of \$T in other industries
 - 2022 US economy lost 1% due to lack of chips to make cars
- Designing/producing semiconductors *can be* **wildly profitable**
 - And **wildly expensive**: \$20B for a new 3nm fab [TSMC, Intel]
- Chipmaking relies on a remarkably complex supply chain for EDA tools, fab tools, materials, energy, cooling, packaging, workforce
 - chip parts “must cross 70 international borders before a final product can be delivered to customers.”
 - No one country has all the pieces...clear threat to defense & industry

\$280B IS A BIG NUMBER

The CHIPS and Science Act of 2022 directs \$280 billion in spending over the next ten years, with the bulk for scientific R&D.

CHIPS and Science Act funding for 2022–26, \$ billion

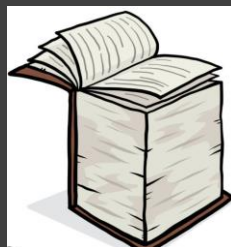
Total **278.2**



NSF budget increases 12% to \$10B FY23. \$335M is specifically to implement C&SA. Congress intent was to double NSF in five years but politics may prevent that. New Directorate for Tech, Innovation, and Partnerships is now running, reviewing proposals.

C&SA: \$50B over 5 years, of which \$11B to adv. semiconductor R&D, and \$39B to boost domestic chip production.

C&SA is > 1K pages long!



Source: Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act of 2022, H.R. 4346, 117th Cong. (2022)

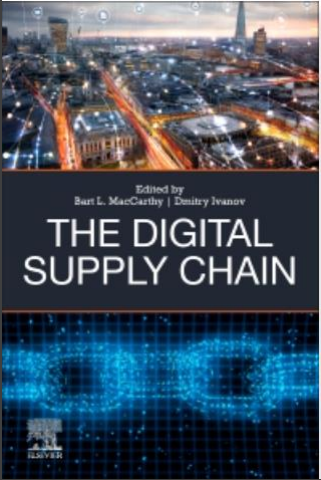
More on NSF

- Congress does not usually tell NSF how to spend its \$\$, but...
 - C&SA identified some “priority areas”
 - Core Research: labs, infrastructure, research fleet, fed R&D centers, HPC
 - AI and Quantum
 - Energy and climate research
 - Major facilities (e.g., telescopes)
 - Mid-scale infrastructure
 - Seismology facilities
 - Research security, esp. w.r.t to open-source
 - Research on power dynamics in research: profs / grad students (esp. foreign nationals)
 - Merit review bias: peer review process, bias reduction
 - Research admin support: emerging/underserved research institutions

Stated Goals of C&SA

“The CHIPS Act established an incentives program to reestablish and sustain U.S. leadership across the semiconductor supply chain.”

1. Incentives for domestic semiconductor manufacturing
2. Investment in research and development (R&D)
3. Support for workforce development
4. Strengthening supply chain security

The image is a promotional banner for 'Supply Chain USA 2023'. It features a dark background with a glowing, golden globe in the center, surrounded by a network of white lines and dots. A hand is shown at the bottom, holding the globe. The text 'REUTERS EVENTS™' is in the top left. The main title 'Supply Chain USA 2023' is in large white letters, with 'Chicago | May 17-18' below it. At the bottom, there are four statistics: '900+ Attendees', '100+ Speakers', '50+ Interactive Sessions', and '20+ Hours of Networking'. The logo 'CUSA23' is in the bottom left corner.

REUTERS EVENTS™

Supply Chain USA 2023
Chicago | May 17-18

900+ Attendees | 100+ Speakers | 50+ Interactive Sessions | 20+ Hours of Networking

CUSA23

Goal 1: Incentives for semiconductor mfg



- \$2B for mature tech node mfg, priority for “critical mfg” (e.g. automotive)
- “Other Transaction Authority” for Dept of Commerce
- Routinely review export restrictions on advanced tech
- Include disadvantaged individuals: minority, women, veterans
- GAO to evaluate Gov’t steps to avoid semiconductor shortages
- \$1.5B for Wireless (5G) Supply Chain Innovation
 - Open arch, SW-based
 - Managed by Nat’l Telecom and Info Administration, NIST, DHS, IARPA
- Adv. Mfg. Investment Credit of 25%
 - “taxpayers could elect to treat this credit as a payment against tax”

Goal 2: \$\$ for R&D



- C&SA establishes a semiconductor investment 25% tax credit of \$24B through 2026
 - Goal is making new fabs more affordable
 - Aimed at semiconductor manufacturing and processing equipment costs
 - Requires cooperation of private investment
- An aside:

Among other things, C&SA also calls for the White House OSTP to “support research and other activities related to the safety and security implications of engineering biology...”

Goal 3: Workforce Development



This \$174B is authorized but not yet appropriated...to “build a sustainable domestic semiconductor industry...”

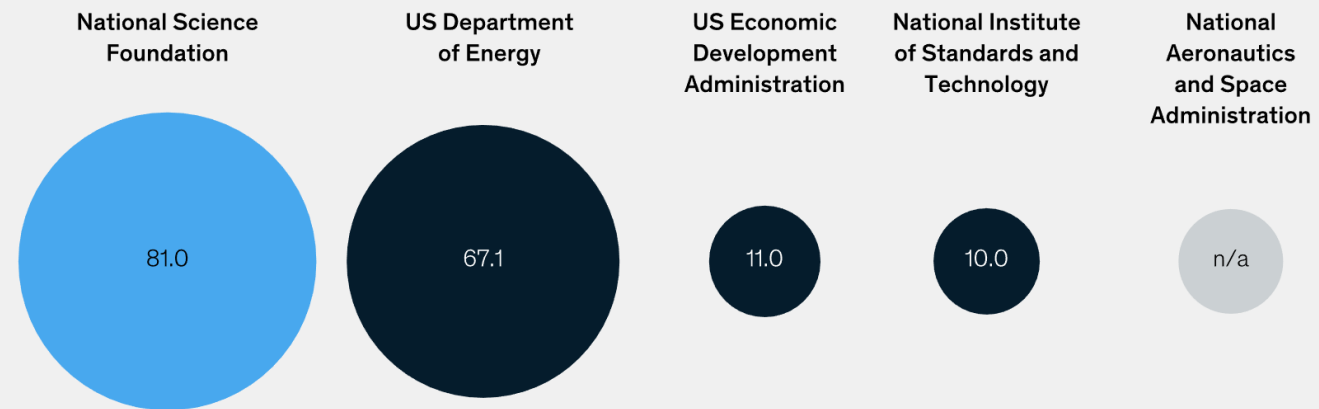
...building and operating the fabs could require > 100K construction workers and 90K workers to operate them...

“...we need all hands on deck to meet the scale of our ambition.”

1. Invest in mfg facilities
2. Partner with industry and education and training providers
3. Support semiconductor education & training
4. Fuel R&D

The CHIPS and Science Act authorizes \$174 billion for investment in science, technology, engineering, and math programs, workforce development, and R&D.

CHIPS and Science Act funding 2022–27,¹ \$ billion



¹Final funding levels subject to future budget appropriations by US Congress.

Source: Congress.gov; Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act of 2022, H.R. 4346, 117th Cong. (2022)

McKinsey
& Company

Goal 4: Supply Chain Security



Note: This new DoD \$\$ is not related to DARPA's Electronics Resurgence Initiative (ERI) program and is not managed by DARPA

Also not *de-conflicted* with ERI...!

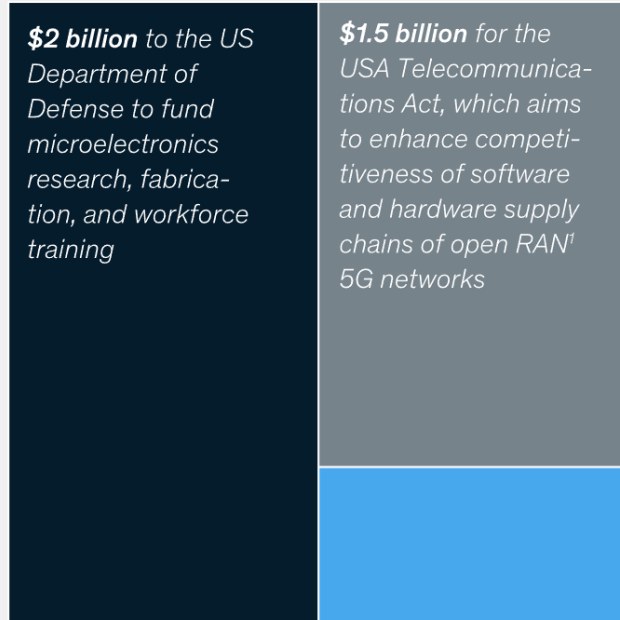
Previous Endless Frontier Act, an earlier piece of legislation that increased fed \$\$ by \$100B over 5 years in AI, HPC, robotics, automation, and advanced mfg.

C&SA consists of Endless Frontier plus CHIPS For America Act

The CHIPS and Science Act will fund a national network of semiconductor technologies for the defense industrial base and investments in supply chain resilience.

Breakdown of national security funding within the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act

Total **\$4** billion



\$2 billion to the US Department of Defense to fund microelectronics research, fabrication, and workforce training

\$1.5 billion for the USA Telecommunications Act, which aims to enhance competitiveness of software and hardware supply chains of open RAN¹ 5G networks

\$500 million to the US Department of State to coordinate with foreign-government partners on semiconductor supply chain security

¹Radio access network.
Source: US Department of Commerce

Rules for C&SA

- Accept CHIPS \$\$: you cannot “significantly expand” chipmaking capacity in China for 10 years
- > \$150M? You must share with the US gov’t a portion of any cash flows that exceed some agreed-upon threshold
- “One of the key requirements for semiconductor manufacturers applying for CHIPS Act funding is the provision of affordable Child Care for their workers.”
 - Addresses shortage of skilled workers: entice more women into tech
- No joint research with foreign entity “that involves sensitive tech”
- Can’t use CHIPS money for stock buybacks
- CHIPS funding triggers National Environmental Policy Act (NEPA) review
 - Would add years to initial new fab operation
- Must pay union wages, use low carbon fuels



https://www.chipsact.com/_files/ugd/2c0542_2493f6abad0e4285a5ac7879c2535c63.pdf

What's the Rest of the World Doing?

- S. Korea announces major tax cuts on semiconductor companies with their “K-Chips Act”
- Likewise India and European Union (“European Chips Act”)

tom's Hardware + Follow

Homegrown 2nm Chips to Cost 10x More Than Today's Mainstream Chips: Rapidus

Story by Anton Shilov • 3h ago

It is estimated that Rapidus — which is backed by the Japanese government as well as Denso, Kioxia, MUFG Bank, NEC, NTT, SoftBank, Sony, and Toyota — will need a budget of JPY5 trillion (\$35 billion) to progress from R&D to mass production. The Japanese government has agreed to financially support the company with a two-year subsidy amounting to a total of \$2 billion. However, other Japanese businesses appear hesitant to invest in Rapidus. For instance, Hitachi is unwilling to invest in

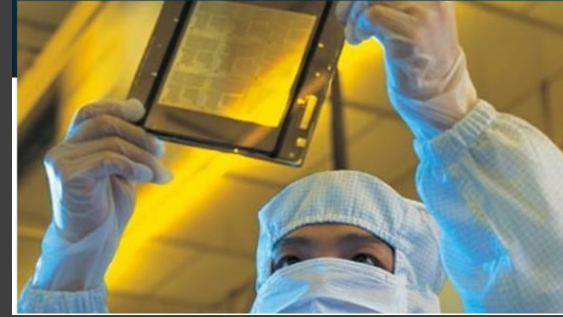
The bill was criticized by Republican House leader [Kevin McCarthy](#) and senator [Bernie Sanders](#) as a "blank check", which the latter equated to a bribe to semiconductor companies.^{[20][41][42]} China lobbied against the bill and criticized it as being "reminiscent of a 'Cold War mentality' ".^[43]

[Pat Gelsinger](#), CEO of Intel, indicated in an earnings call on September 30, 2022 that, thanks in part to CHIPS Act subsidies, the company was exploring building empty fab buildings (known as a "shell-first strategy") and aggressively acquiring smaller competitors before installing any equipment, in order to avoid contributing to a predicted semiconductor glut.^{[39][40]}

TSMC starts building 3nm plant in Taiwan worth \$20B

By Matt Hamblen • Nov 4, 2019 09:01am

semiconductor manufacturing semiconductors AMD Apple



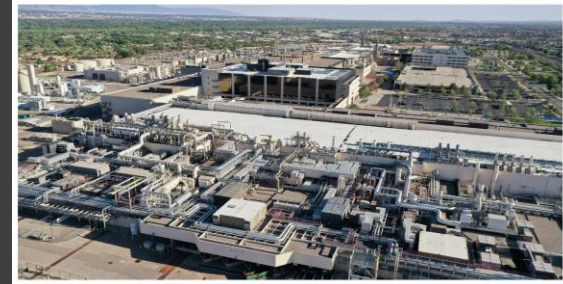
<https://www.fiercееlectronics.com/electronics/tsmc-starts-building-3nm-facility-taiwan-worth-20b>

Germany to Pour \$22 Billion into Chip Production: Intel, TSMC to Benefit

By Anton Shilov published 1 day ago

Intel and TSMC set to get lion's share of Germany's chip subsidies.

[f](#) [t](#) [v](#) [p](#) [r](#) [m](#) [c](#) Comments (1)



What Does US Industry Think?

- Some concern that C&SA benefits fab-companies (Intel, Micron, T.I.) much more than fabless (AMD, NVIDIA, Qualcomm)
 - Fabless companies asked for chip design tax credits but didn't get 'em
- But generally even fabless companies support C&SA
- Letter to Congress 12/2021 urging approval for C&SA signed by 60 CEOs

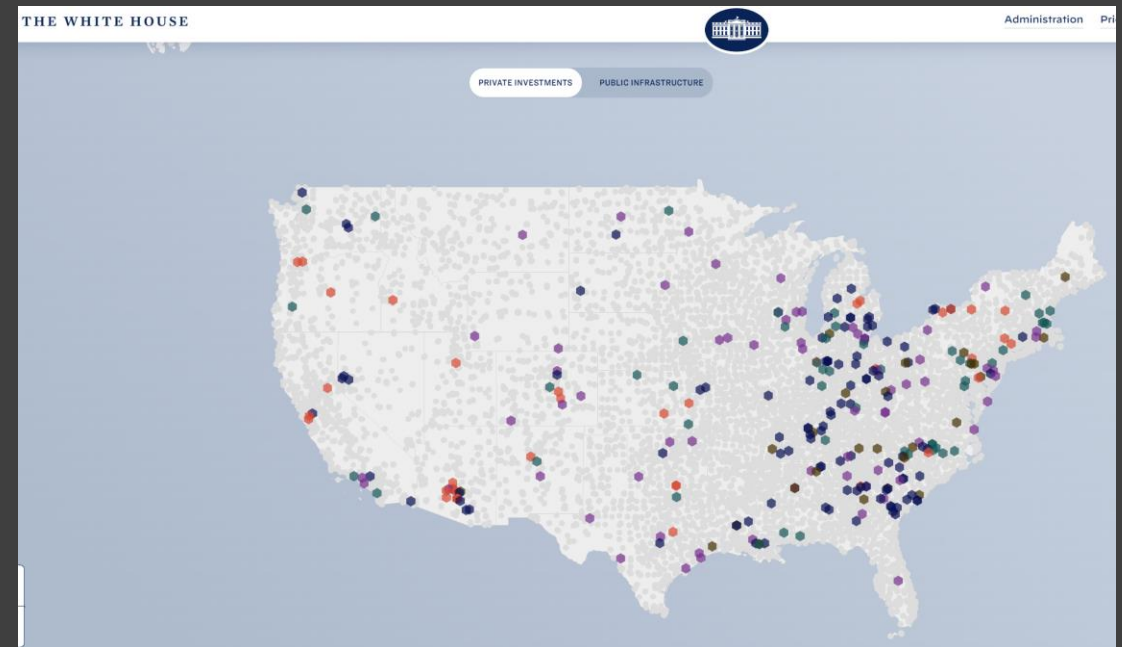
December 1, 2021

The Honorable Nancy Pelosi Speaker of the House U.S. House of Representatives Washington, D.C. 20515	The Honorable Kevin McCarthy House Republican Leader U.S. House of Representatives Washington, D.C. 20515
The Honorable Charles Schumer Senate Majority Leader U.S. Senate Washington, D.C. 20510	The Honorable Mitch McConnell Senate Republican Leader U.S. Senate Washington, D.C. 20510

Dear Madam Speaker, Leader Schumer, Leader McConnell, and Leader McCarthy:

On behalf of the undersigned business leaders representing major companies behind the products and technologies driving innovation and growth throughout the economy, and supporting millions of jobs for Americans, we call on Congress to take prompt action to fund the "Creating Helpful Incentives for the Production of Semiconductors" (CHIPS) for America Act and enact a strengthened version of the "Facilitating American Built Semiconductors" (FABS) Act to include an investment tax credit for both design and manufacturing.

As you know, semiconductors are essential to virtually all sectors of the economy – including aerospace, automobiles, communications, clean energy, information technology, and medical devices. Unfortunately, demand for these critical components has outstripped supply, creating a global chip shortage and resulting in lost growth and jobs in the economy. The shortage has exposed vulnerabilities in the semiconductor supply chain and highlighted the need for increased domestic manufacturing capacity.



Where the C&SA \$\$ is projected to go

A Concern

“My vote in favor of the CHIPS Act was a vote to support a once-in-a-lifetime investment in Ohio; protect critical national security interests; and provide opportunities for the people I represent by bringing good-paying jobs back to America,” said U.S. Rep. Troy Balderson, R-Zanesville

<https://www.dispatch.com/story/news/2022/07/28/chips-act-four-ohio-republicans-boost-bill-pushed-intel/10176845002/>

But competitive chip making needs ongoing development...
can this Act really succeed as a one-time event?

And

Why so little recognition of the end of Moore’s Law as a precipitating event for C&SA?

CHIPS Act Application Process

To apply for CHIPS Act program funding, there is a five-part process. See [Fact Sheet: CHIPS Program Funding Opportunity](#) for more details.

1. **Statement of Interest.** Applicants must describe the proposed project so that the CHIPS Program Office may determine interest in the program and plan for further review.
2. **Pre-Application (Optional).** Potential applicants have the option to submit a more detailed description of their project plan(s). The CHIPS Program Office will provide written feedback, including recommendations for next steps (i.e., whether the applicant should submit a revised pre-application, a full application, or neither).
3. **Full Application.** Full applications need to contain detailed information on the project(s), including the technical and financial feasibility and alignment with economic and national security objectives. The CHIPS Program Office may either provide feedback or request further information. Before moving into the due diligence phase, the CHIPS Program Office will prepare and seek agreement to a non-binding Preliminary Memorandum of Terms, which will include recommendations for the award's amount and form and may also include terms related to other strategic objectives.
4. **Due Diligence.** If the CHIPS Program Office determines an applicant is likely to receive an award, the application will enter the comprehensive due diligence phase. During this phase, the CHIPS Program Office will require the applicant to provide additional information on national security, financial, environmental, and other issues and will engage at the applicant's expense with outside advisors, consultants, and/or attorneys to validate the information provided in the application.
5. **Award Preparation and Issuance.** After successfully completing due diligence, the Department of Commerce will prepare and issue an award. Direct funding and loans will ultimately be disbursed in tranches tied to project milestones.

Ways You Can Participate

NIST.GOV/CHIPS

The screenshot shows the NIST CHIPS.GOV website. At the top, there is a search bar and a menu icon. Below the navigation bar, a blue banner features the CHIPS.GOV logo and the tagline "CHIPS: Investments in innovation, resilience, and a more competitive American future". The main content area is divided into two rows of cards. The first row includes: 1) The CHIPS for AMERICA logo (an American flag with circuit traces). 2) A card with an icon of a person and gears, titled "New! A funding opportunity for the semiconductor supply chain". 3) A card with a gear and a chip icon, titled "Learn more about incentives for commercial fabrication facilities". 4) A card with a monitor and gear icon, titled "Materials and resources to support your incentives application". The second row includes: 5) A card with a lightbulb and gear icon, titled "Get the latest publications from CHIPS Research and Development". 6) A card with a network icon, titled "A new teaming list helps applicants find potential partners". 7) A card with a group of people and gear icon, titled "Learn more about the Industrial Advisory Committee". On the left side of the second row, there is a vertical menu with the following items: "A Message from the Secretary of Commerce", "Implementation Strategies", "Funding Opportunity - Commercial Fabrication Facilities", and "Research and Development Program", each with a plus sign to its right.

“The CHIPS Act team helps with expert grant writing, building political support for grant proposals and obtaining private capital to meet matching funds requirements.”
-- chipsact.com

Thank You

- Acknowledgments
 - **Mark Rosker, Carl McCants** (DARPA)
 - **Margaret Martonosi** (NSF)
 - **Matt Francis** (Ozark Integrated Circuits, Inc.)
- None of the errors in this presentation are their fault.
 - They did the best they could with the available talent. (Me.)

Questions? Comments?

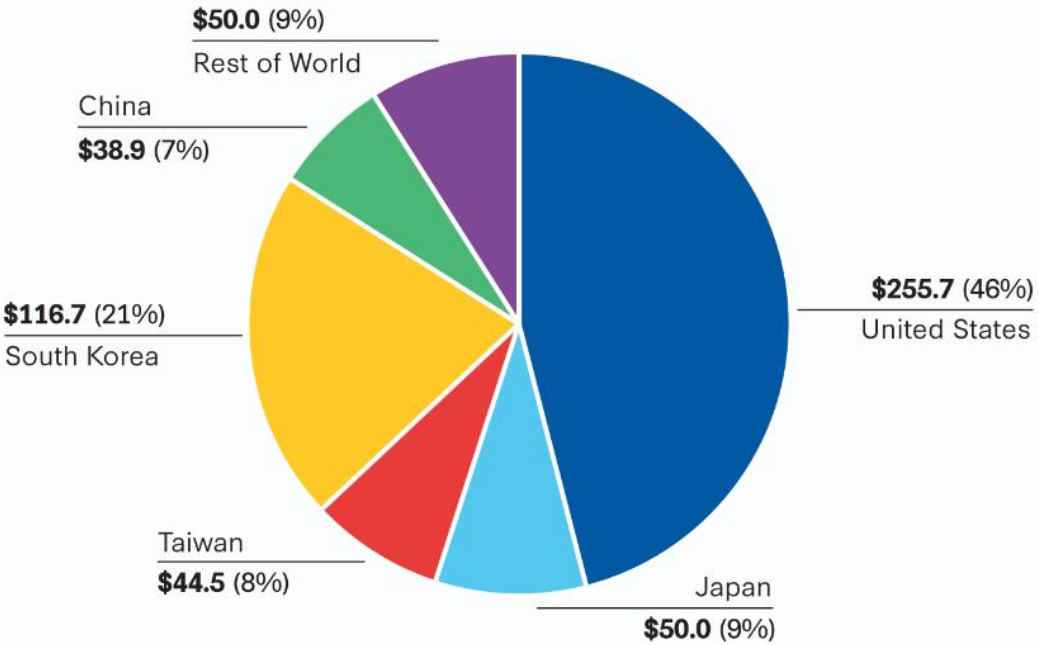
Backups

Worldwide Share of Semiconductor Market '2021

Semiconductor Sales by Country (2021, in billions)

Total semiconductor sales in 2021: \$555.9 million

■ United States ■ Japan ■ Taiwan ■ South Korea ■ China ■ Rest of World



Source: "SIA Factbook 2022," Semiconductor Industry Association, May 2022, https://www.semiconductors.org/wp-content/uploads/2022/05/SIA-2022-Factbook_May-2022.pdf.

What these kinds of numbers look like in print

5 *(ii) for fiscal year 2023,*
6 *\$7,000,000,000 to remain available until*
7 *expended, of which \$5,000,000,000 shall be*
8 *for section 9902 of Public Law 116–283 and*
9 *\$2,000,000,000 shall be for subsections (c),*
10 *(d), (e), and (f) of section 9906 of Public*
11 *Law 116–283;*

Other Transaction Authority

Top 5 Takeaways for Using Other Transaction Authority (OTA)

The key take aways for understanding, developing, and utilizing OTA are listed below.

1. An OTA is a procurement authority that allows federal agencies to enter into agreements with non-traditional defense contractors, such as small businesses, research institutions, and nonprofit organizations.
2. They allows agencies to bypass certain Federal Acquisition Regulation (FAR) requirements, which can speed up the acquisition process and make it more flexible.
3. Can be used for a variety of purposes, including prototyping, research and development, and follow-on production.
4. Agreements are typically used for projects that are innovative, Medium to High-risk, or have a short timeline.
5. Agreements can be beneficial for both the government and contractors, as they can provide a faster and more flexible way to develop and acquire new technologies and capabilities.
However, they may also be subject to greater scrutiny and oversight due to the unique nature of the agreements.