

SkyWater Technology

A continuing legacy of semiconductor manufacturing excellence in Minnesota

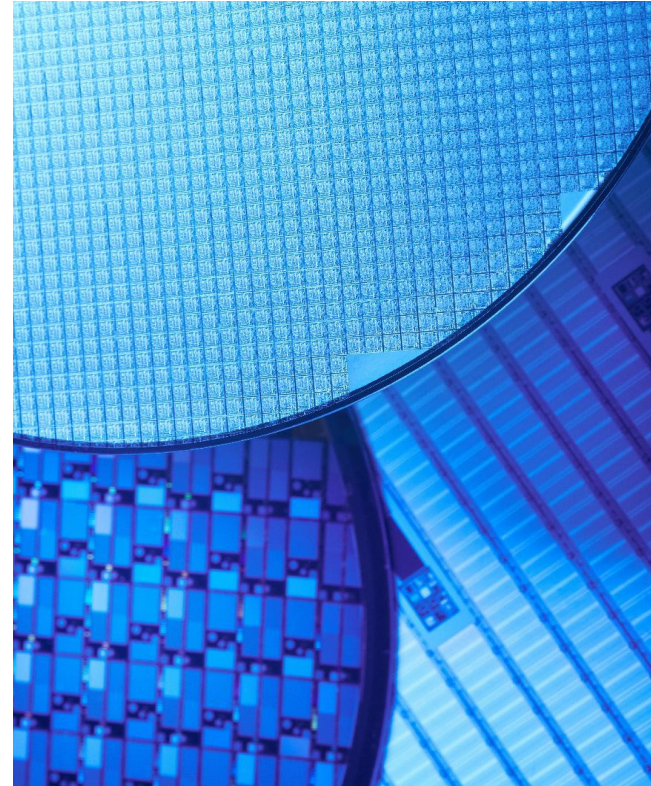
Dr. Brad Ferguson (UofMN BS ChemEng '93)
Chief Government Affairs Officer
SVP/GM, Aerospace & Defense Business Unit
SkyWater Technology

Semiconductors are the Fuel
of the 21st Century Economy

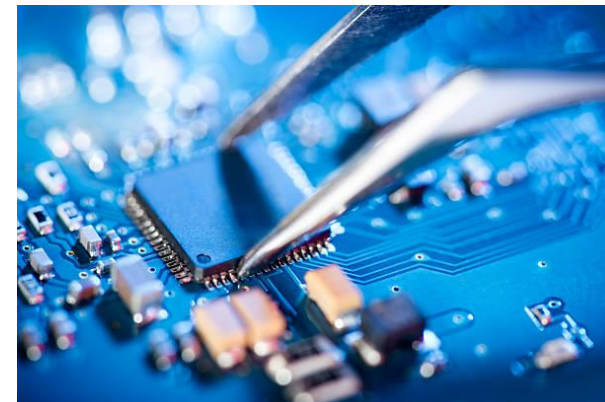


What is a Semiconductor?

- Also called integrated circuits, ICs, chips, or microchips
- Semiconductors are an important part of our modern lives and an essential component of ALL electronic systems
- Most anything with an on/off switch has a semiconductor in it!



Completed Silicon Semiconductor Wafers – shown with many devices fabricated all at once



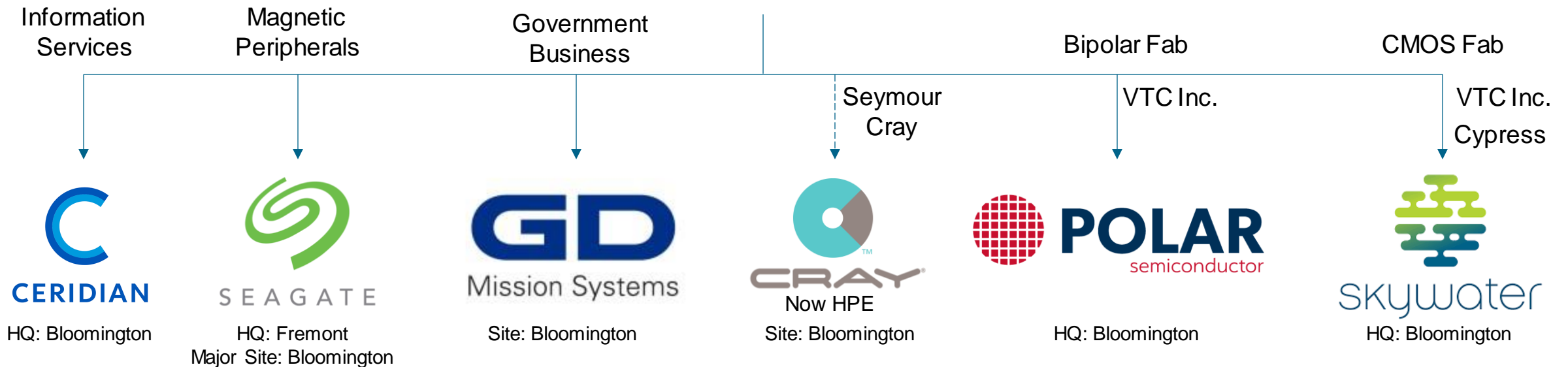
Each tiny device is singulated (diced), packaged into a single product, then assembled into a board or module

A continuing legacy of Innovation, Based in Minnesota

Mainframe Computer Pioneer
In Business 1957 – 1992
HQ: Bloomington, MN
Dominant market position
Peak: \$2.93B / 18,000 employees



Predecessor Companies
WWII Navy Crypto Team
ERA → Rand → Sperry
Founders left to form CDC



→ CHIPS: A unique opportunity to reclaim our heritage as the Silicon Heartland



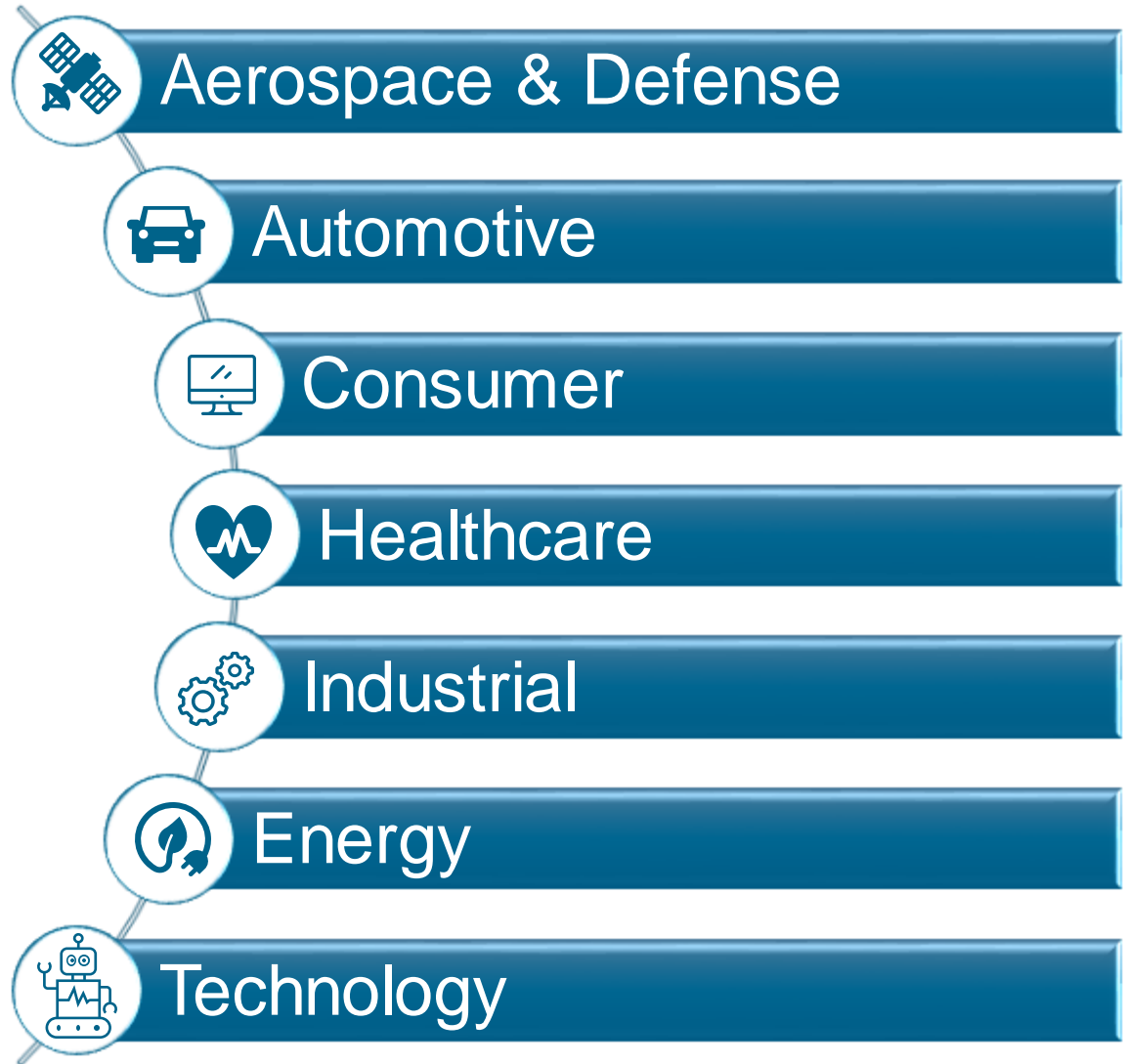
The Semiconductor Industry Enables Many Others

COVID-19 underscored the importance of semiconductors for remote work, telehealth, rapid vaccine development, among many other areas.

AI and 5G/6G are the most promising catalysts to put the 4th industrial revolution on a fast track.

New disruptive tech will fuel exponential growth:
75 years to reach \$500B in revenue
By 2030 revenue will reach \$1.3T (*)

(*) International Business Strategies January 2022



→ Semiconductor Infrastructure is critical for national and economic security

A Dynamic World Drives the Semiconductor Industry

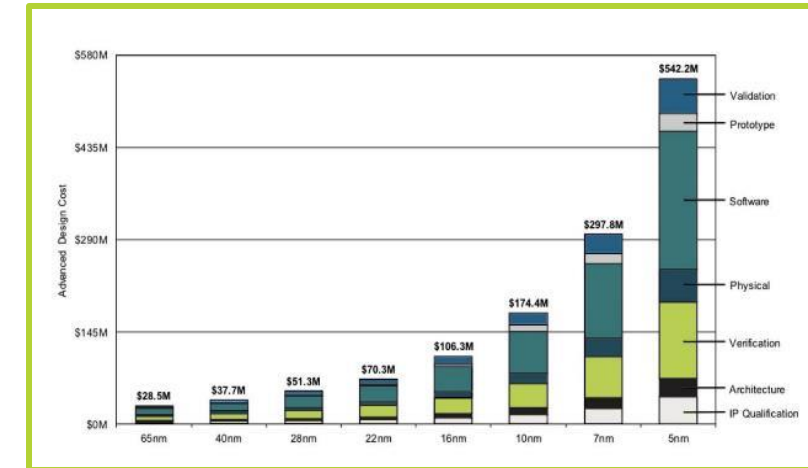
IP and Information Security Risks are Growing Concerns



Supply Chain Risks motivate Reshoring and Improved Transparency



Costs of New Product Design are Rising Exponentially

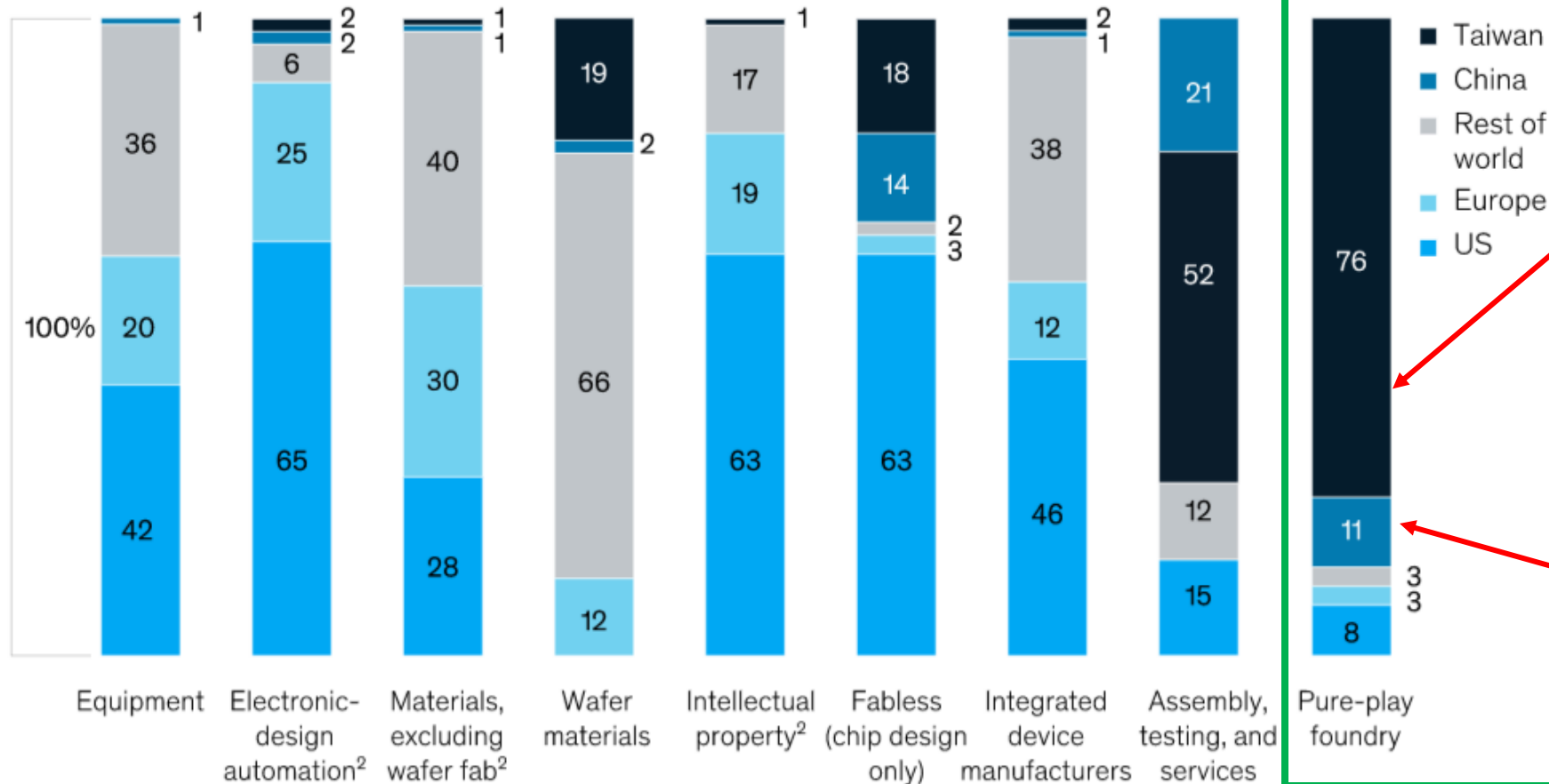


Most semiconductor innovation and equipment is produced in the US,
but only **12%** of microelectronics manufacturing happens in the US.

Source: Richard Waters. "US chip industry plots route back to homegrown production." *Financial Times*. Aug 2020.

Semiconductor Manufacturing is Concentrated in Asia

2020 semiconductor sales along the value chain,¹ % share



Taiwan dominates the Foundry market

A "Silicon Shield" protects Taiwan from China

China is investing \$150B to capture chip tech

Pure-Play foundries are primarily overseas

Source: Ondrej Burkacky, Marc de Jong, and Julia Dragon. "Strategies to lead in the semiconductor world." McKinsey & Company. Apr 2022. <https://www.mckinsey.com/industries/semiconductors/our-insights/strategies-to-lead-in-the-semiconductor-world>

SkyWater is Revolutionizing Technology Realization



SkyWater's Unique Model Accelerates Disruption

OPEN ACCESS FOUNDRY SERVICES

Technology as a ServiceSM (TaaS)SM

Innovation as a Service



Manufacturing as a Service

Advanced Technology Services (ATS)
enable co-creation of differentiated solutions which are the unique expression of the combined customer/SkyWater multi-disciplinary technology teams.



Wafer Services
supply customers with ICs and microdevices for commercial or mission ready products.



Prototyping



Production

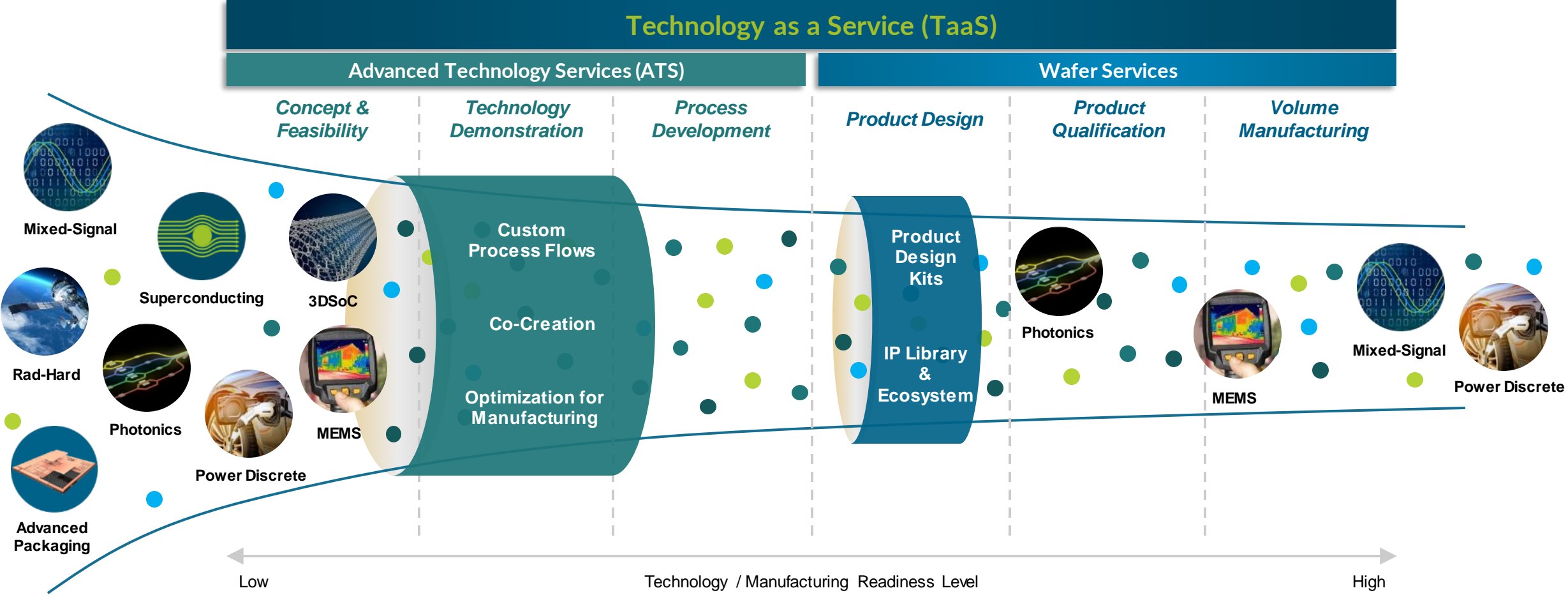
OUR TaaSSM MODEL

Co-creates disruptive technologies

Security Overlay enables support for Defense and Secure Applications

Leverages manufacturing scale for efficiency, speed, and reproducibility

SkyWater's Model Enables Fabless Innovation



✓ **Efficient R&D**

✓ **Accelerated Time-to-Market**

✓ **Volume Manufacturing**



Bloomington, MN



Kissimmee, FL



West Lafayette, IN

OPERATION

- >600 employees
- 200 mm equipment
- 91,000 ft² Cleanroom (Class 10 + SMIF)
- 10,000 30 ML CMOS wafers/month or 50,000 MOSFET wafers/month
- 65 nm+ feature geometries

CERTIFICATIONS

- ISO9001 Quality Management System Certified
- ISO9100/IATF16949 Automotive Certified
- ISO13485 Medical Certified
- AS9100 Aviation, Space and Defense Certified
- ISO14001 Environmental Certified
- DMEA Cat 1A Trusted since 2010
- ITAR and Secure Processing Supported

>\$1B capital investment



OPERATION

- ~50 employees
- 200 mm equipment
- 35,400 ft² Cleanroom (class 1,000 & class 10,000)
- Site added to operation Feb 2021
- Facility will enable custom heterogeneous integration solutions
- Unique Public-Private Partnership (PPP)
 - Site/fab owned by Osceola County
 - SkyWater operates facility
 - Ecosystem partner with BRIDG (nonprofit)

CERTIFICATIONS

- ISO9001 Quality Management System Certified
- DMEA Cat 1A Trusted – pending, planned 2023

\$250M capital investment

FUTURE OPERATION

- ~750 employees
- 200mm/300mm Capability
- Embedded R&D Capability
- Intelligent Automation and Decision Making
- Trusted Certification
- Advanced Wafer Fabrication and Packaging
- Industry Partnership Network (Customers and Suppliers)

SITE PLANS

- Groundbreaking in 2023
- 30-36 months to begin production
- 650,000 ft² Facility; 100,000 ft² Cleanroom
- Approximately 750 employees (5000 indirect)
- Technology platform decisions will rely heavily on customers needs

\$1.8B+ capital investment

Chips & Science Act of 2022 and How SkyWater will Execute



President Biden Signs the CHIPS & Science Act of 2022

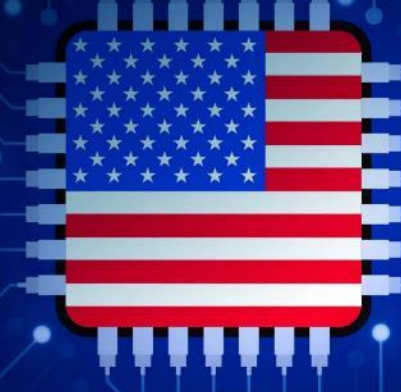


August 9, 2022: SkyWater President & CEO Thomas Sonderman attended the signing of the historic CHIPS legislation in a Rose Garden ceremony at the White House. From **President Biden holding up a SkyWater wafer** at the virtual Chip Summit in 2021 to the **signing of the CHIPS & Science Act of 2022**, SkyWater has supported this critical initiative every step of the way.

SkyWater Applauds Historic Legislation to Stimulate US Semiconductor Production



skywater



CHIPS & Science Law & SkyWater Minnesota

CHIPS Funding Source	Federal Budget	SkyWater Vision Budgets are notional totals
1. Incentives program for building and expanding semiconductor manufacturing	\$39B	Phase 1: fab upgrade plus tooling to double fab output up to \$500M investment and 200+ direct jobs (1000 indirect) add GaN capability, 65nm CMOS, migrate to Copper Phase 2: 200mm fab expansion investment TBD, +150 direct jobs (750 indirect) add 65k-90k of fab cleanroom space, triple current output
2. NIST R&D Program: APMP Advanced Packaging Mfg Program NSTC National Semiconductor Tech Center	\$11B	NSTC site as part of ASIC Coalition – IBM-led NSTC coalition SkyWater on governance committee
3. DoD Commons R&D network of labs, fabs, and startups for prototyping	\$2B	This program mirrors our business model: lab-to-fab transition Serve as a Core site supporting multiple Technology Hubs
4. Investment Tax Credit for equipment placed in service 2023-2026	25%	Use to increase leverage on all investments

- Department of Commerce will expect to see significant State & Local support for a CHIPS Manufacturing project to demonstrate support and buy-in from the local economy
- Semiconductor Industry is extremely capital-intensive – our site in MN is small compared to leading edge fabs despite well over \$1B in capital tooling & investments

How SkyWater will Execute

	Minnesota	Florida	Indiana
Legislation Criteria	Department of Employment and Economic Development	Enterprise Florida & Florida Department of Economic Opportunity	Indiana Economic Development Corporation
Workforce Development	University of Minnesota Normandale Community College Hennepin Technical Community College	University of Central Florida Valencia College & Osceola Technical College NeoCity Academy High School	Purdue University Ivy Tech Community College Greater Lafayette High Schools
Synergistic Innovation	SkyWater Advanced Technology Services (R&D inside a production scale fab)		
Secure Manufacturing	SkyWater Wafer Services (pure-play foundry blending defense and commercial business) Directly addresses the preference for entities willing to serve USG and commercial		

We have been actively engaged for >2 years in our target states and with relevant entities. Department of Commerce guidelines will drive final CHIPS submittals in early 2023.

Public-Private Partnerships Work...We Need More!



MN Fab expansion commissioning

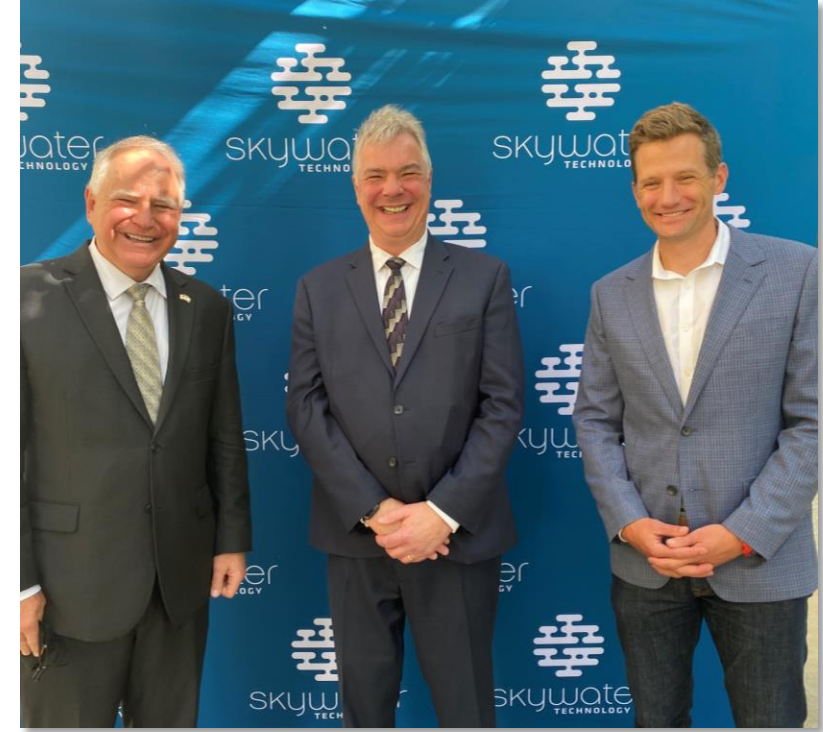


Partnership with Osceola County

Engagement with National, State and Local Government



SkyWater Visit: Governor Walz and Commissioner Grove Affirming Minnesota's commitment to supporting chip industry



September 16, 2021: Minnesota Governor Tim Walz and Department of Employment and Economic Development Commissioner Steve Grove visited SkyWater to discuss the chip shortage and how to increase capacity in existing fabs. After the tour, a press conference was held to discuss the importance of passing and enacting the USICA legislation and Governor Walz committed Minnesota to provide state matching funds.

SkyWater Visit: U.S. Rep. Betty McCollum (HAC-D), Under Secretary of Defense (R&E) Ms. Heidi Shyu, Principal Director for Microelectronics Dr. Shenoy



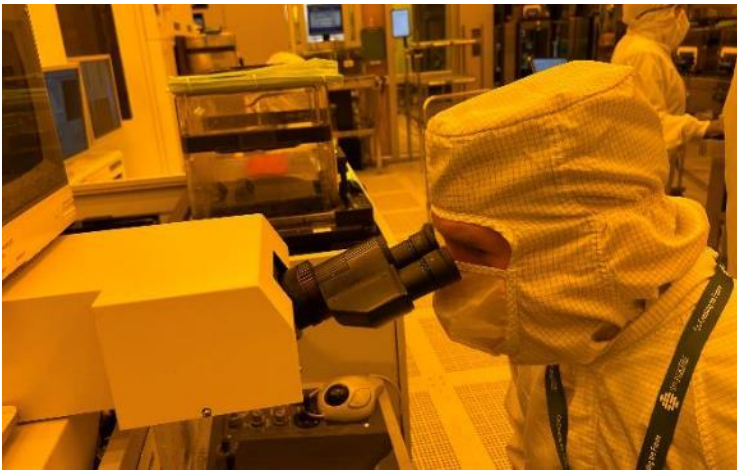
October 7, 2022: We were pleased to host this delegation for a tour of our clean room and a discussion about the **U.S. semiconductor industrial base and investments** Congress has made in microelectronics with the CHIPS Act.

Senator Amy Klobuchar Visits SkyWater



August 16, 2022: We were pleased to host Senator Klobuchar at our SkyWater Minnesota facility to **celebrate the historic CHIPS & Science Act of 2022**. We were joined by guests from Seagate, Onto, TEL and the University of Minnesota. The CHIPS grants, if awarded to in-state companies, will help Minnesota to reclaim its legacy of leadership in this industry.

U.S. Rep. Dean Phillips Visits SkyWater Minnesota



August 11, 2022

Rep. Dean Phillips visited SkyWater and spent some time working inside our fab and talking with our executives about how SkyWater hopes to use funds from the CHIPS Act to accelerate investments to increase capacity at our Minnesota facility.

Also hosted MN Rep. Pete Stauber and several other legislators at SkyWater



How Chips are Made



Sand



Silicon
Boule



Silicon
Wafers



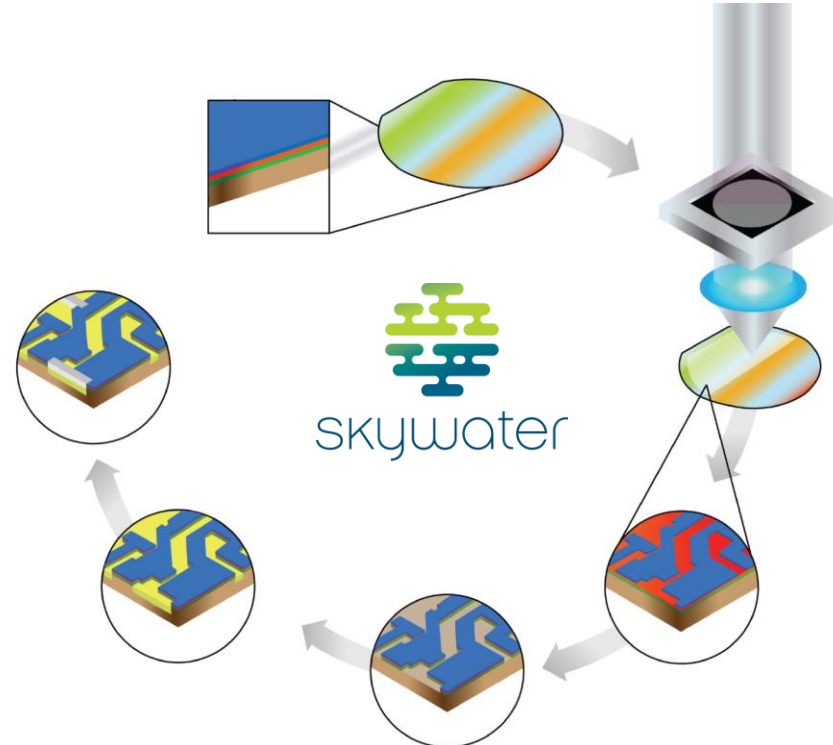
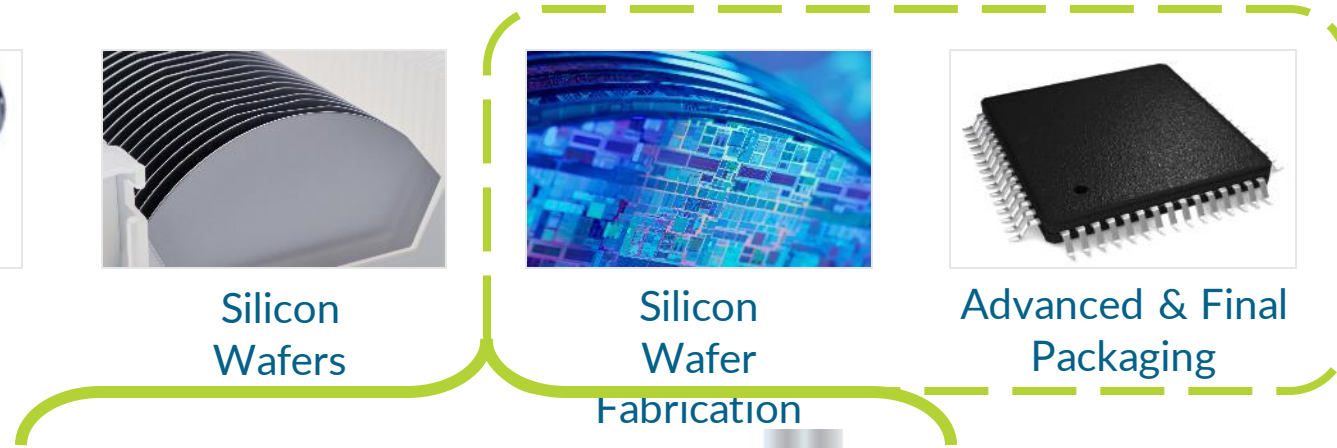
Silicon
Wafer
Fabrication



Advanced & Final
Packaging



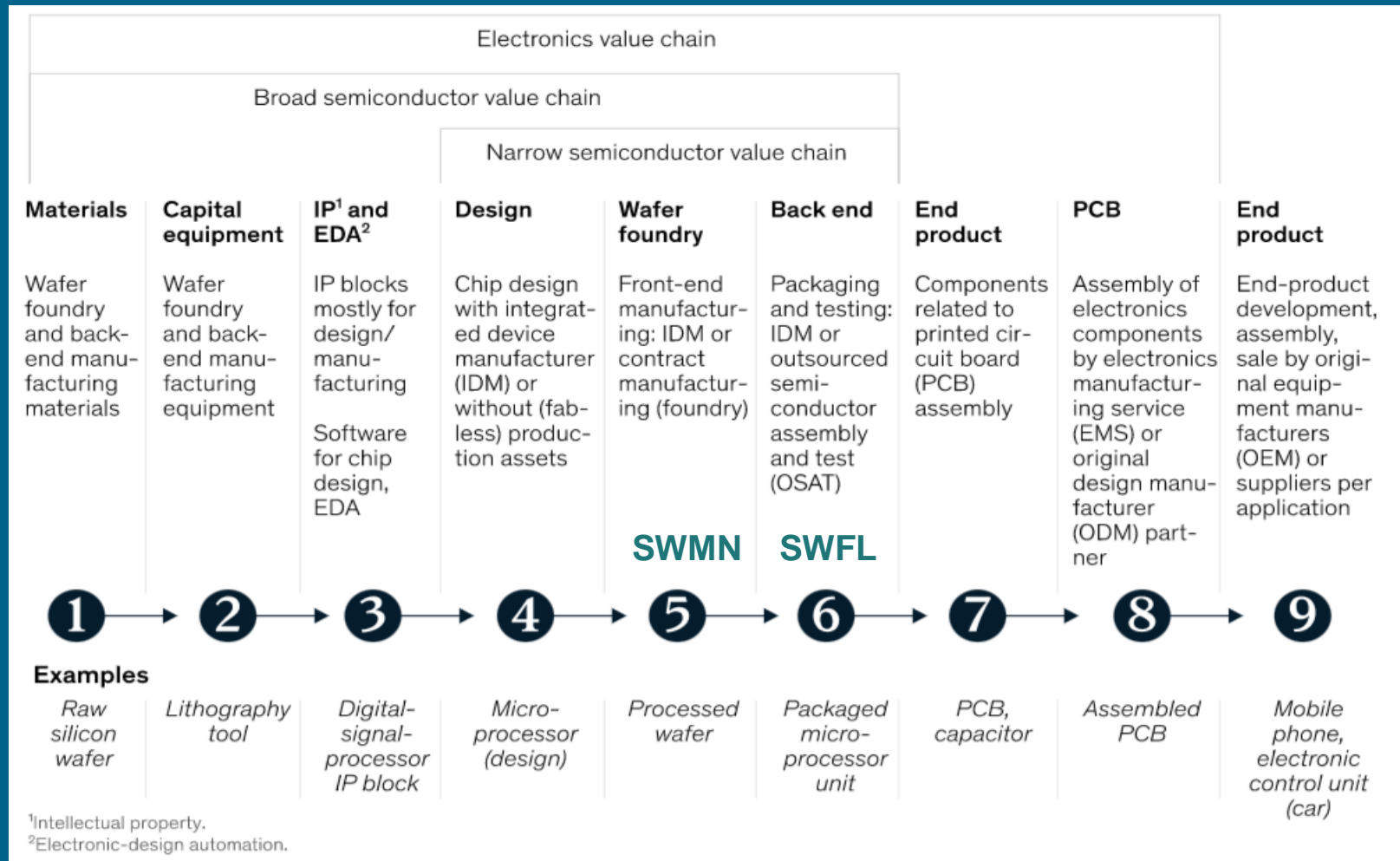
Board
Assembly



CHIPS & Science Act: Four Key Elements

1. Manufacturing Incentives Program: \$39B to enhance and scale-up domestic manufacturing
Legislation requires a mix of Federal, State/Local, and Industry funding - percentages not defined
Federal funding may include a mix of instruments, for example grants, loans, and loan guarantees
2. R&D Investments to strengthen and advance U.S. leadership in semiconductors: \$11B
 - NSTC (National Science and Technology Center), NAPMP (National Advanced Packaging Manufacturing Program), and Manufacturing USA
3. DoD Commons Program: \$2B
 - Goal is to bridge the valley of death from lab to fab & productization
 - Network of academic labs, semiconductor fabs, and startups/innovators to accelerate DoD prototyping
4. Investment Tax Credit of 25% for semiconductor manufacturing capital launched 2023-2026
 - Partially offsets Asian incentives (30-40%+) and other advantages
 - Department of Commerce will expect to see significant State & Local support for a CHIPS Manufacturing project to demonstrate support and buy-in from the local economy
 - Semiconductor Industry is extremely capital-intensive – our site in MN is small compared to leading edge fabs despite well over \$1B in capital tooling & investments

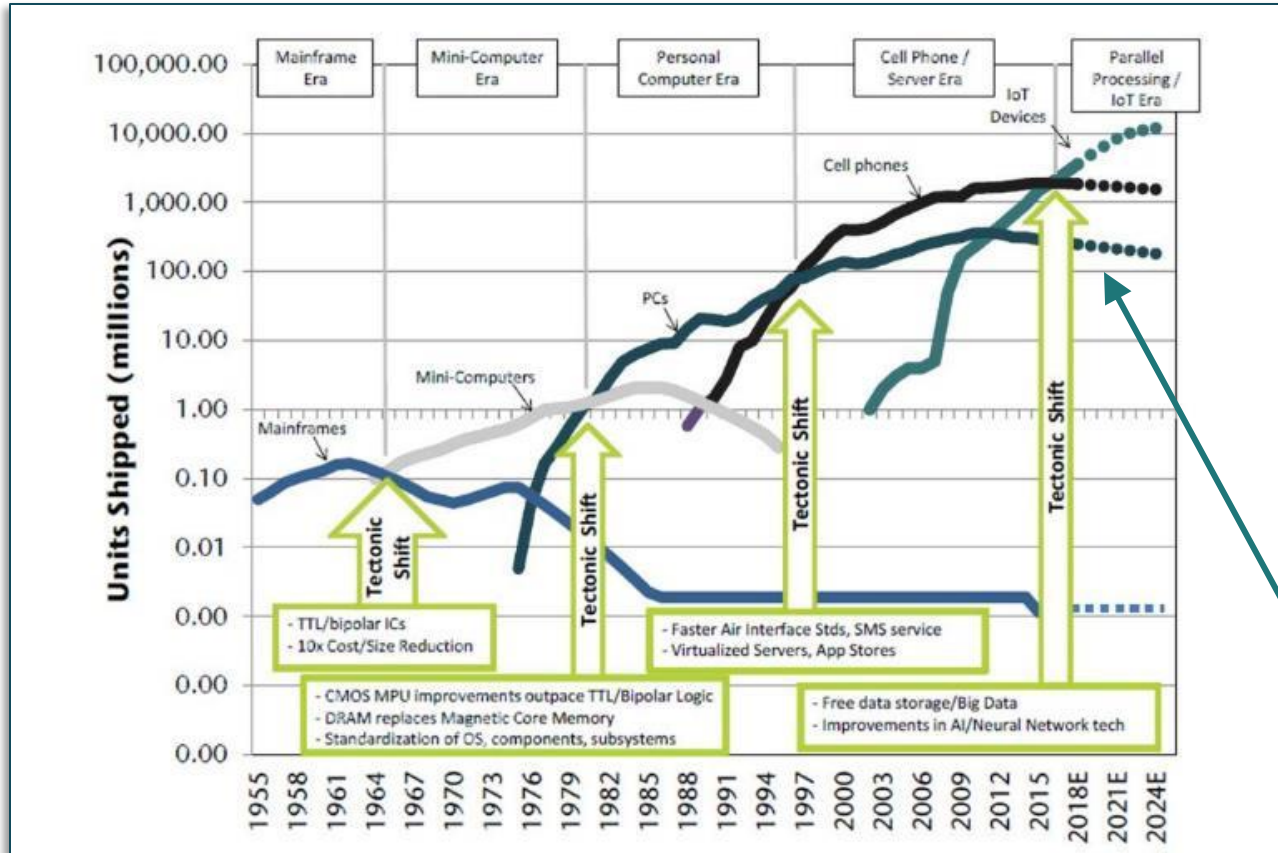
Electronics Requires a Highly Complex Value Chain



Wafer foundry is just one step in the value chain

Source: Ondrej Burkacky, Marc de Jong, and Julia Dragon. "Strategies to lead in the semiconductor world." *McKinsey & Company*. Apr 2022.
<https://www.mckinsey.com/industries/semiconductors/our-insights/strategies-to-lead-in-the-semiconductor-world>

Moore's Law* Has Shaped the Industry











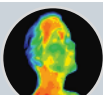








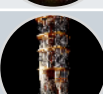













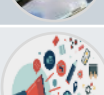
Source: Jefferies Report: *The 4th Tectonic Shift in Computing: To a Parallel Processing / IoT Model.*

* Moore's Law states that the number of transistors doubles every 1-2 years with corresponding reductions in cost, *Electronics 1965 et seq, G. Moore*

- Transistor scaling lowers device costs and increases performance
- Scaling increases complexity and costs
- Substrate size increases for more area
- Fabs grow to achieve economy of scale
- Foundry model emerges then dominates to displace internal fabs
- Fewer can afford to chase leading edge
- Foundries concentrate in lower-cost regions (Taiwan, China)

The **Next Wave** of computing is **now**

Enabling the Next Wave... SkyWater Chips in Action

Technology Platform	Real World Application					
Mixed-Signal CMOS	 Smart Sensors & Wearables	 Edge Processing	 Power Management	 Battery Management		
Rad-Hard	 Strategic Defense Systems	 Commercial & Deep Space	 Implantable Medical Devices	 Nuclear Power Generation		
MEMS	 Thermal Imaging	 Bio-Diagnostics	 Genetic Sequencing	 Inertial Navigation		
Power Discrete	 Power Management	 DC/DC Voltage Conversion	 AC/DC Power Conversion	 Battery Management		
Superconducting	 Supercomputing	 Quantum Computing	 Quantum Sensing	 Green Datacenters		
Photonics	 Datacenter Transceivers	 Optical Interconnects	 Automotive LiDAR	 Bio Diagnostic Arrays		
Carbon Nanotubes	 Neuromorphic Computing	 Edge AI	 Extreme Low-Power IoT	 Strategic Defense Systems		
Heterogeneous Integration	 Advanced Computing	 High Density Memories	 Imaging	 Communications		

The Fastest Path to More Silicon is Expanding Capacity in Existing Fabs while Building New Fabs

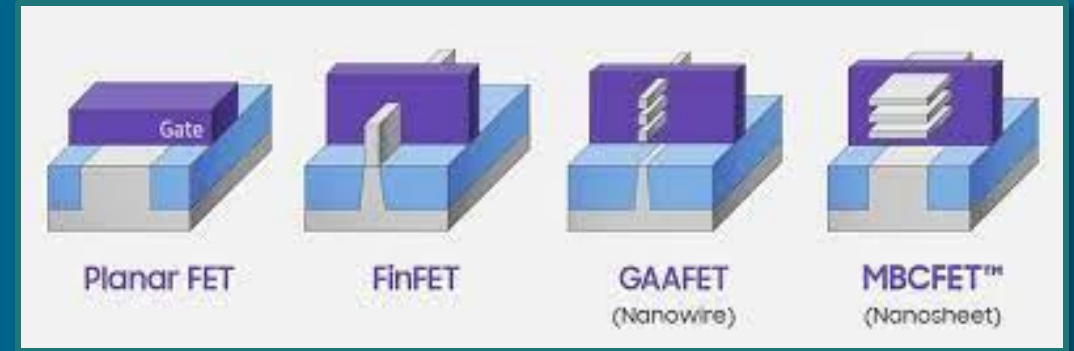
Invest in Increased Capacity Today



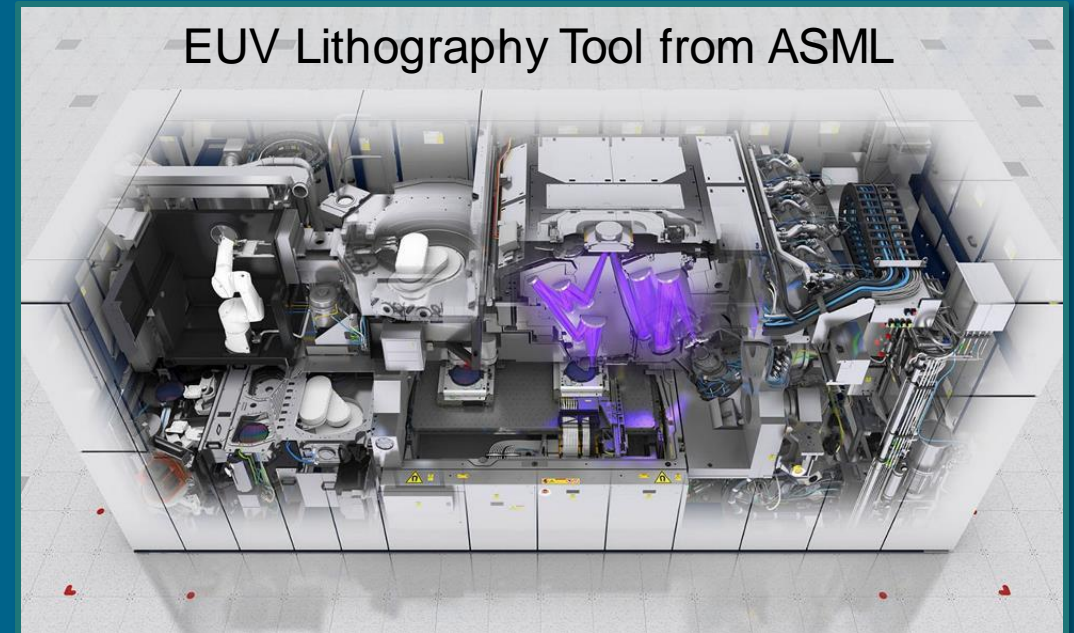
Build the Fabs of the Future

...but Moore's Law is Expensive!

- While technology continues to improve performance, it comes with complexity which drives COST
- Critical lithography tools cost \$100M+
- New leading-edge fab costs over \$20B!
- Such numbers stifle innovation



<http://www2.eecs.berkeley.edu/Pubs/TechRpts/2020/EECS-2020-41.html>

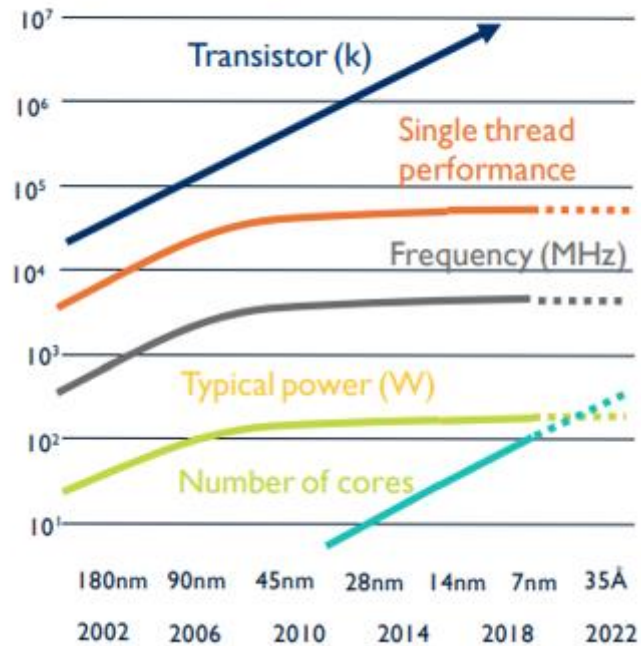


<https://spectrum.ieee.org/asml-developing-next-gen-euv-lithography>

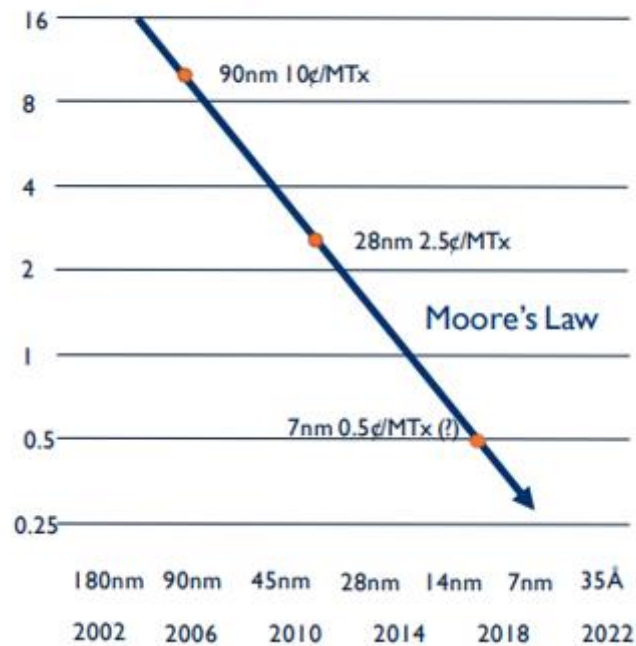
The Pace of Progress Has Slowed

Note: Y-axes are all logarithmic

Microprocessor performance (FLOPS)



Mfg Cost (¢ per Million Transistors)

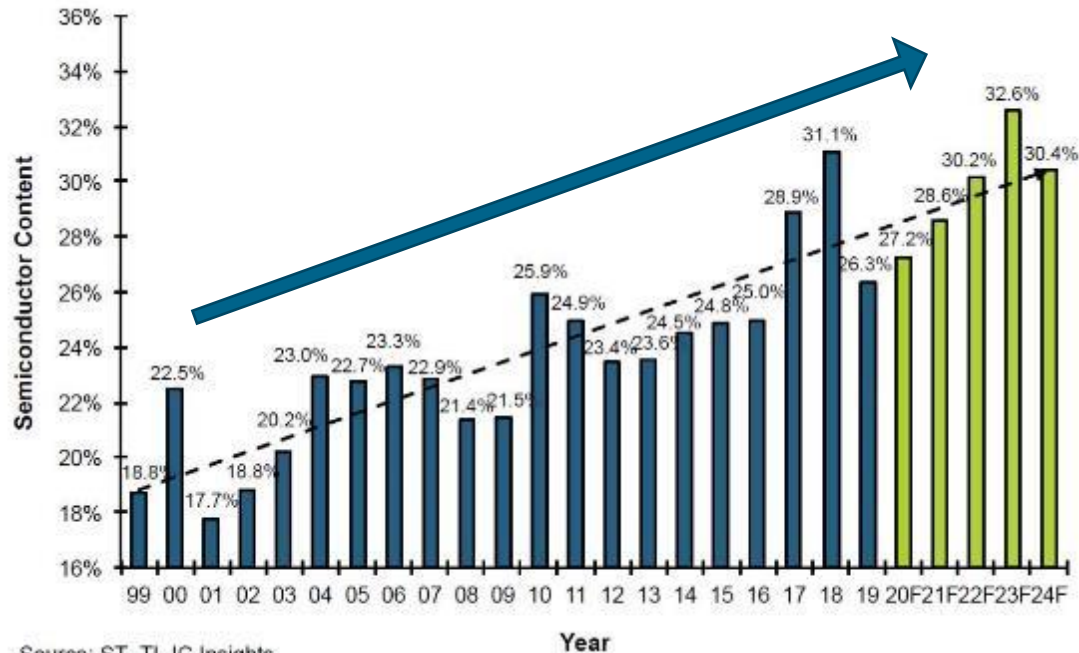


Design Cost (\$M)

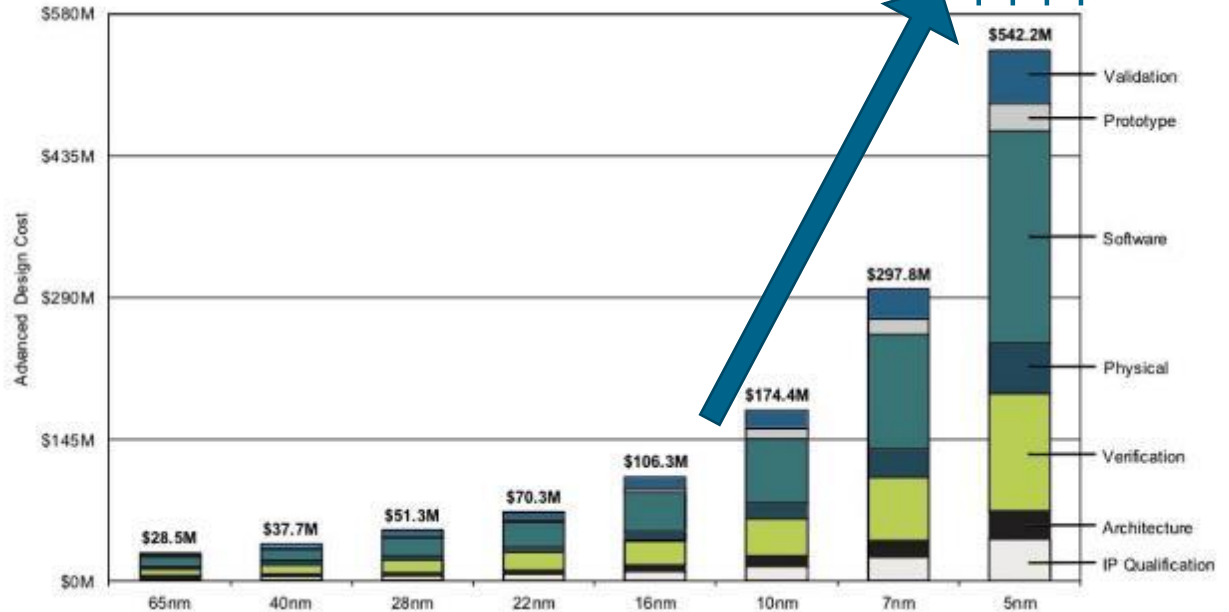


The Semiconductor Industry is at an Inflection Point... the Next Wave is Here

Electronic System Semiconductor Content
Continues to rise



Semiconductor Design
Costs Grow Exponentially



\$0.5B to prototype a new design at 5nm

\$\$\$\$

CHIPS LONG TERM GOAL: Balanced and Secure Microelectronics Supply Chain for National and Economic Security

PAST

Concentrated in
Asia

Inefficient
Innovation

Lack of IP
Protection

Logistically
Complicated



FUTURE

Regionally
Balanced

Synergistic
Innovation

Protected IP

Efficient Logistics

Transparency

National Semiconductor Technology Centers to Drive Synergistic Innovation



Incubation at university labs,
national labs and private labs



Coalesce best new ideas w/
predefined corridors to scale



Mechanism to rapidly move
innovations to defense &
commercial markets



Domestically available R/D
centers and end-to-end
volume manufacturing

We streamline the concept to production journey.

Technology as a Service

Innovation as a Service



Manufacturing as a Service



We are the only U.S. Investor-owned pure-play foundry

Extending a legacy of manufacturing
excellence to meet the industry's needs
in a **post-Moore's Law** reality

