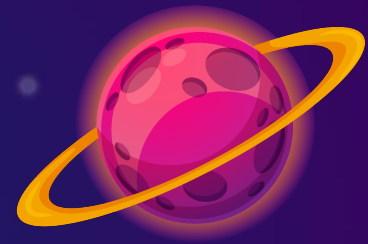


CHIP WARS



Episode 2023


Return of the Tech Divide



About me



Software Engineer from Berlin
with roots in German hacker culture
& wireless communities

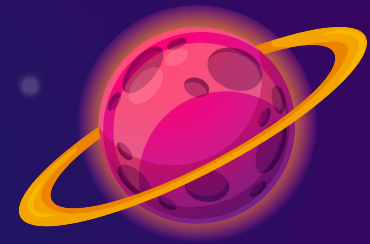


Arrival in Taiwan by mid 2000s
on discovery mission where the
hardware is coming from

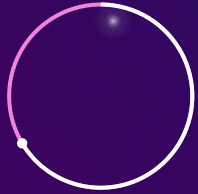


Hardware development & production
from large commercial to open
hardware projects

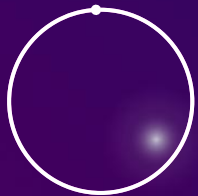
Roadmap



IC 102



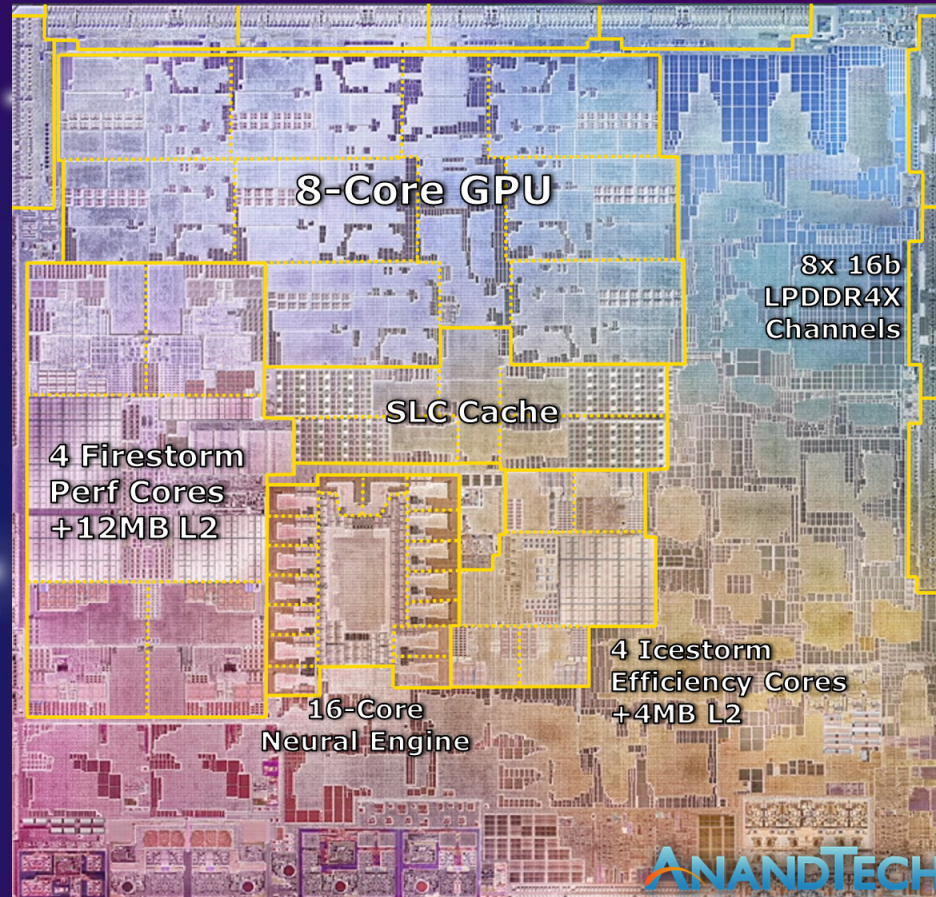
2022/2023



Outlook

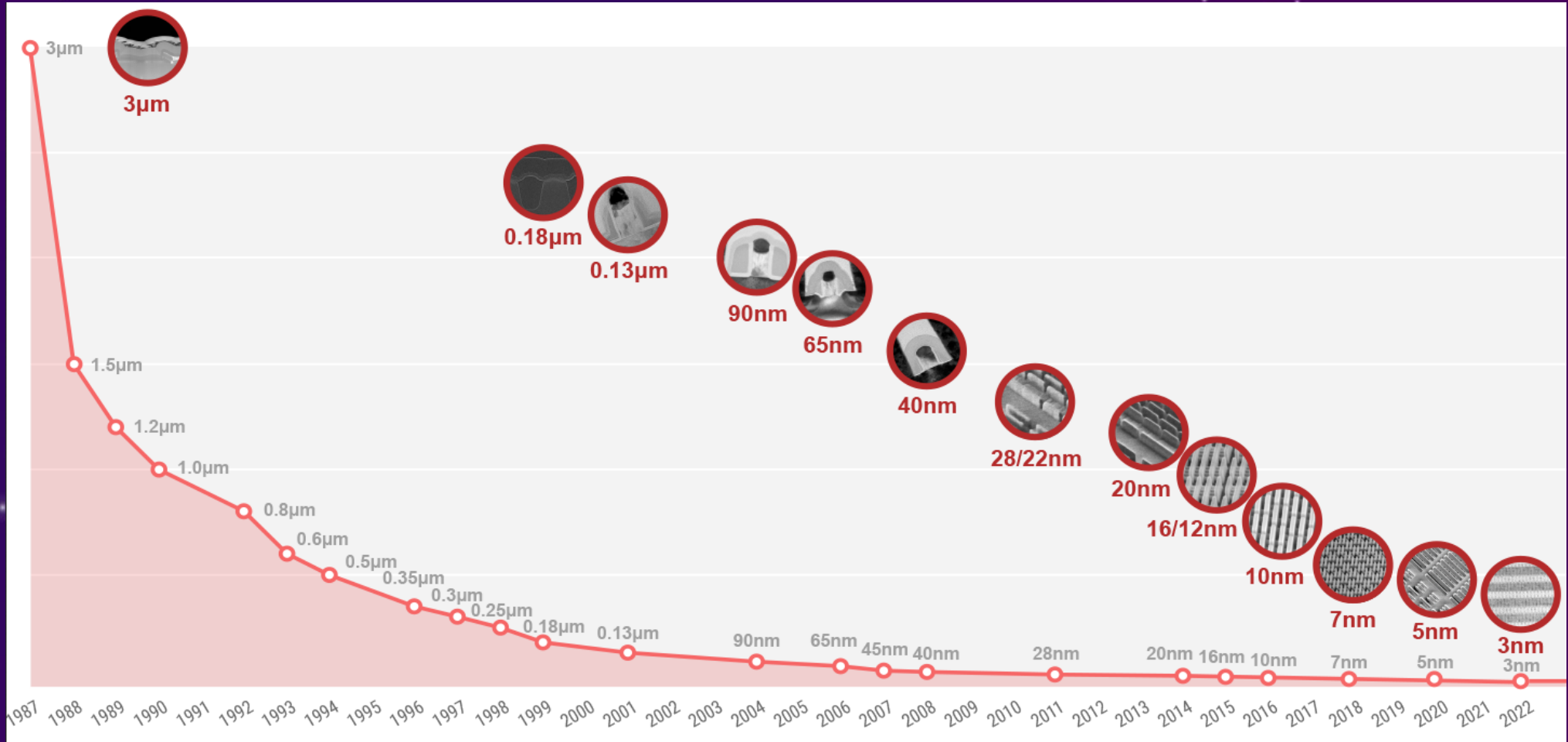


Apple M1 Silicon

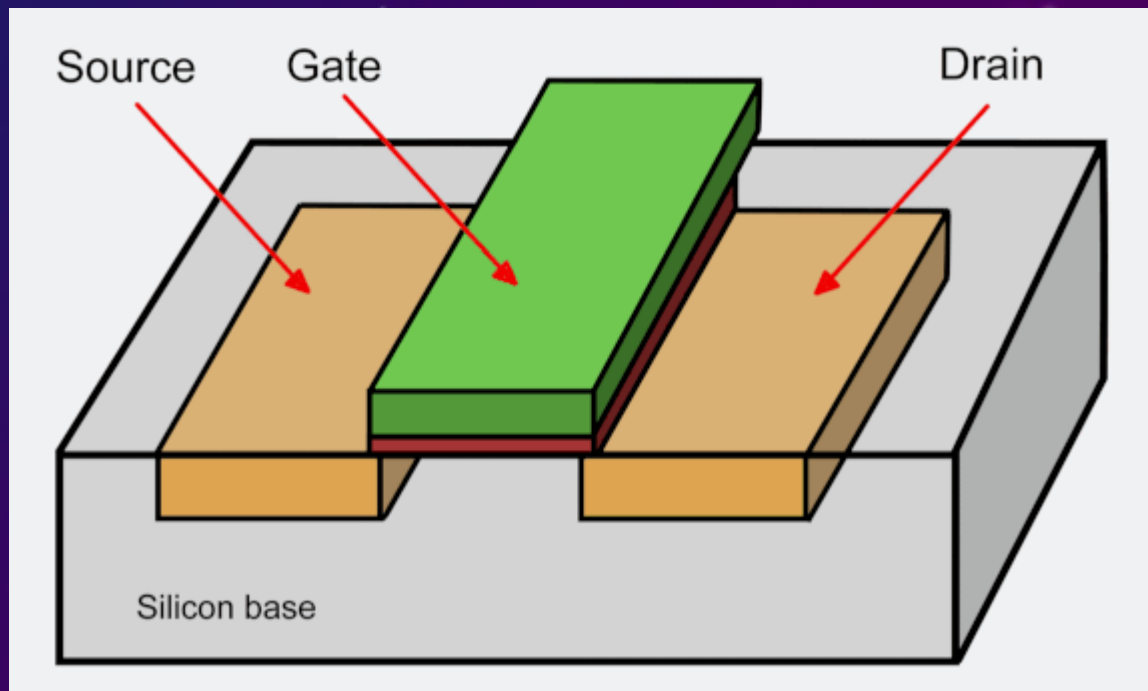


Technology: 5nm
Dimensions: 119mm

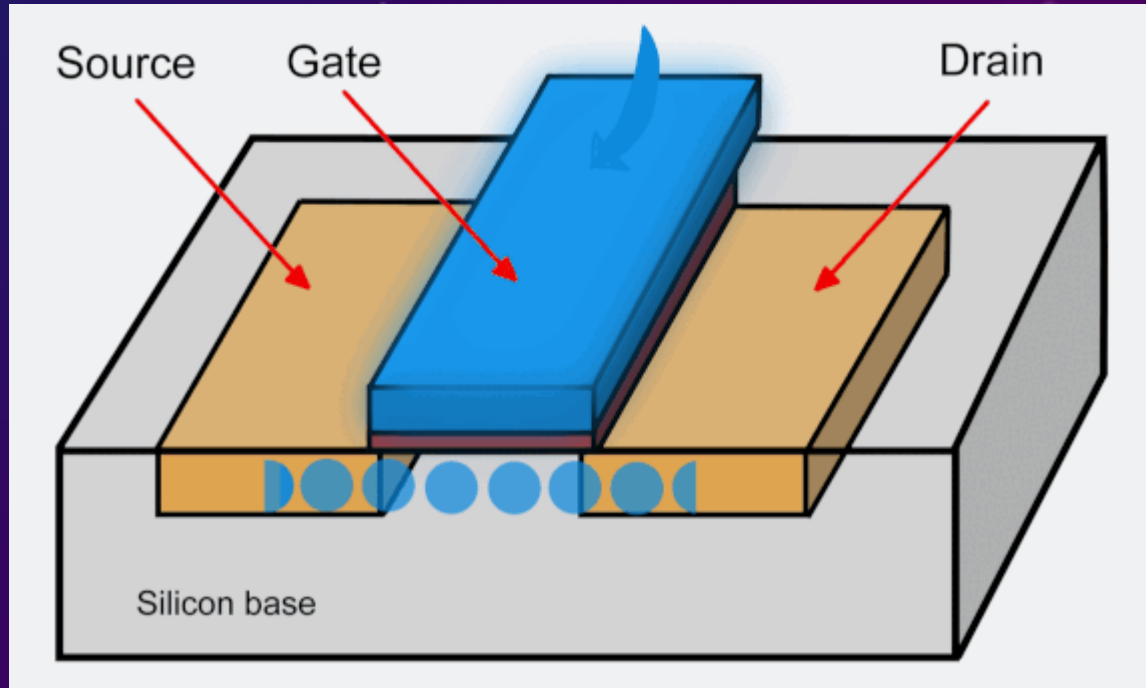
Nanometers



Transistor in a nutshell



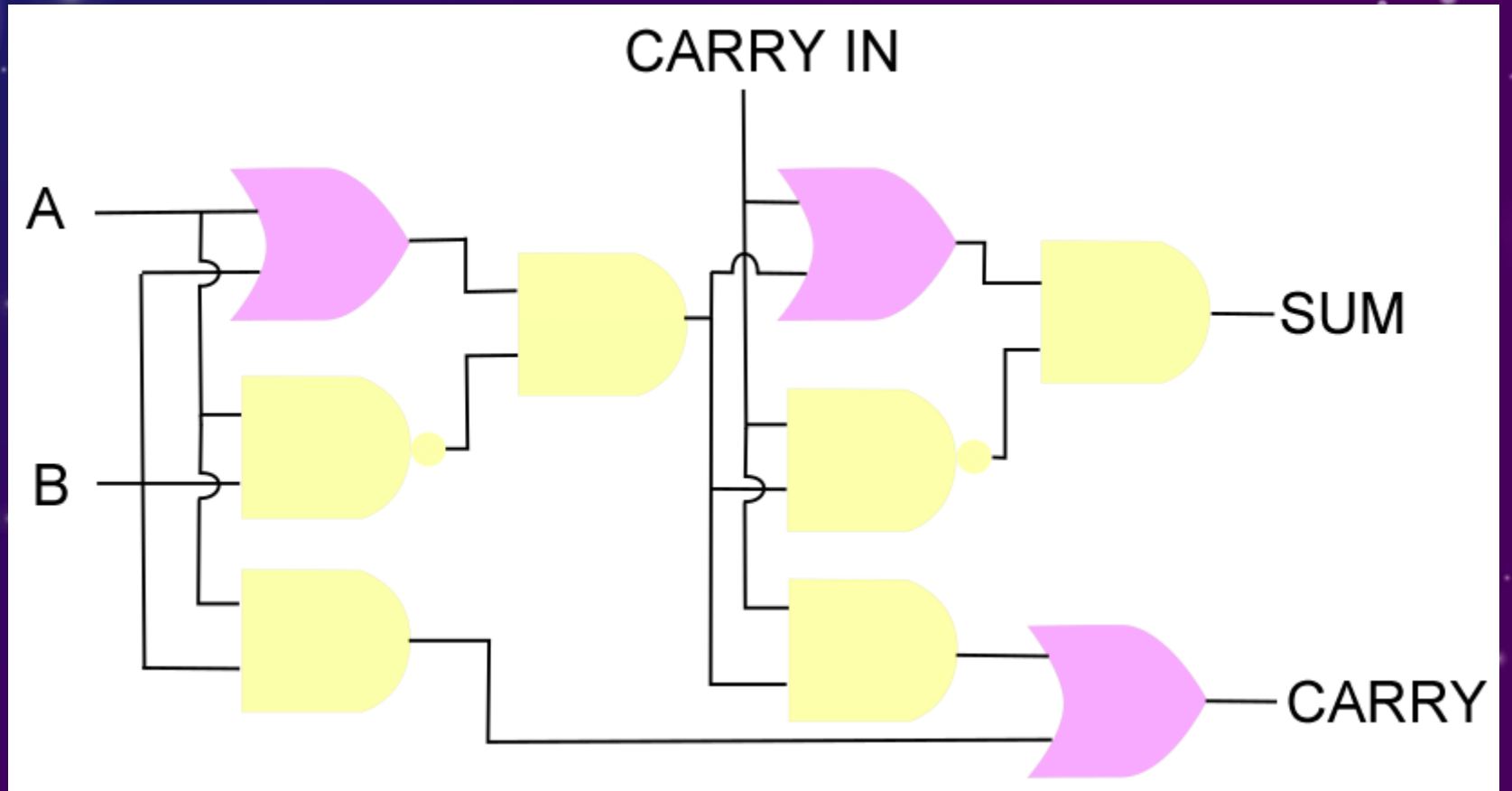
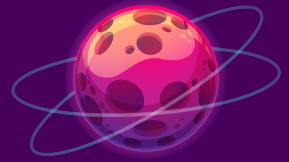
Transistor in a nutshell (II)



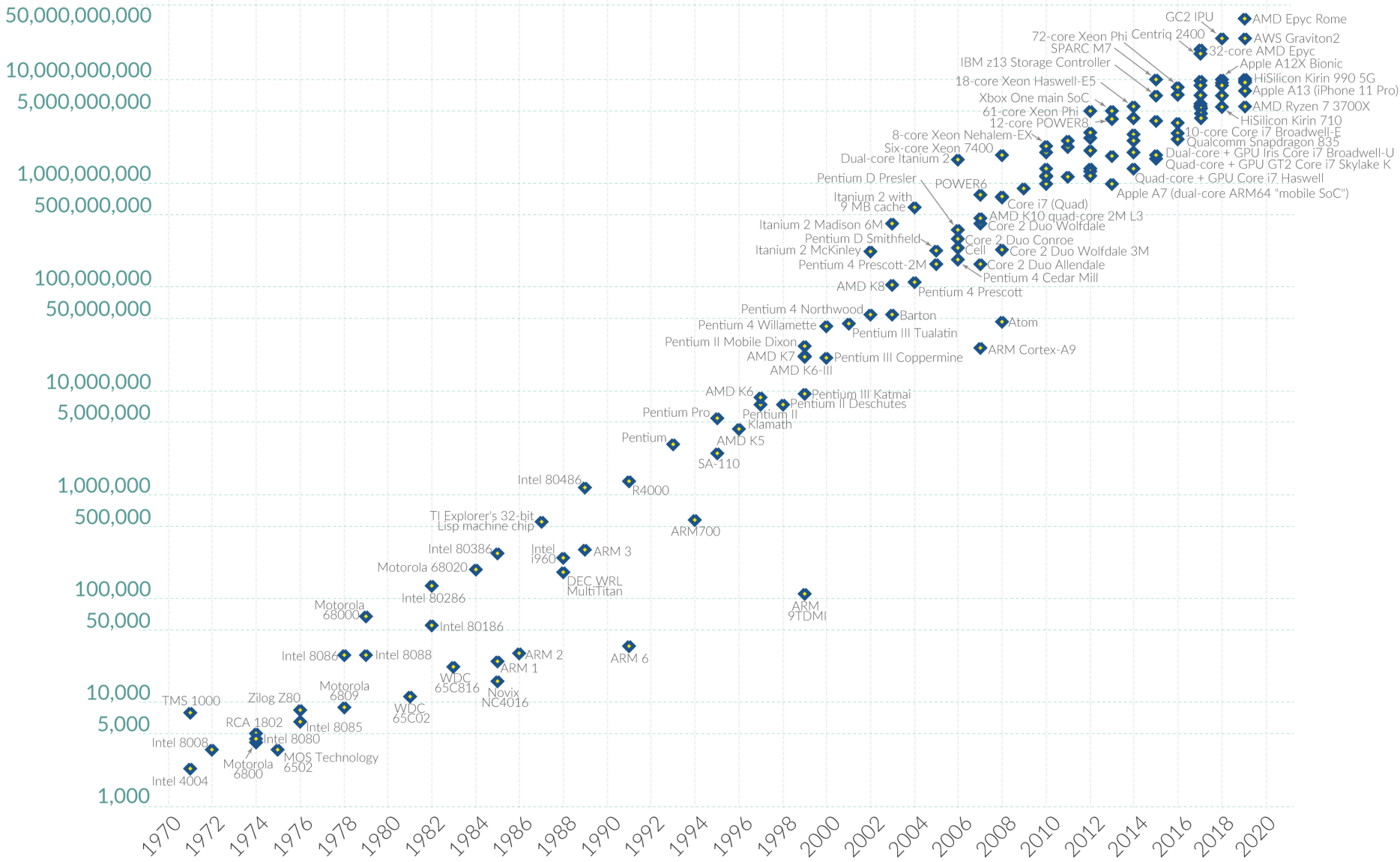
Transistor in a nutshell (III)



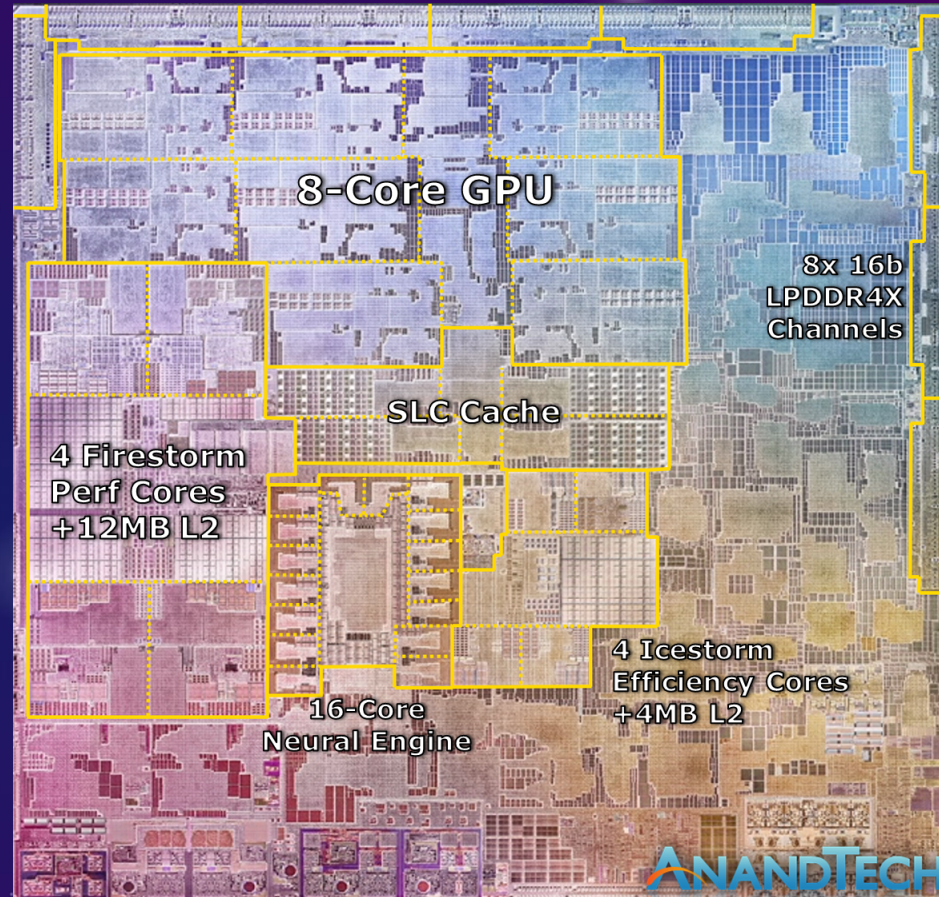
Transistor in a nutshell (IV)



Transistor count



Apple M1 Silicon



Technology: 5nm
Dimensions: 119mm
Release date: 2020
Transistors: 16billion

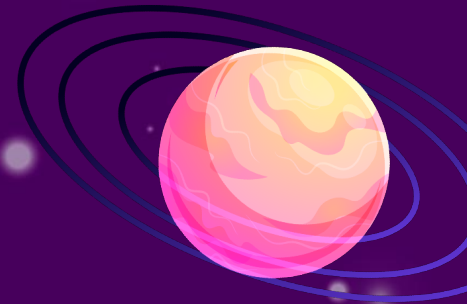
Transistors vs power vs cost



Power, Performance, Area (PPA)



Power, Performance, Area, Cost (PPAC)

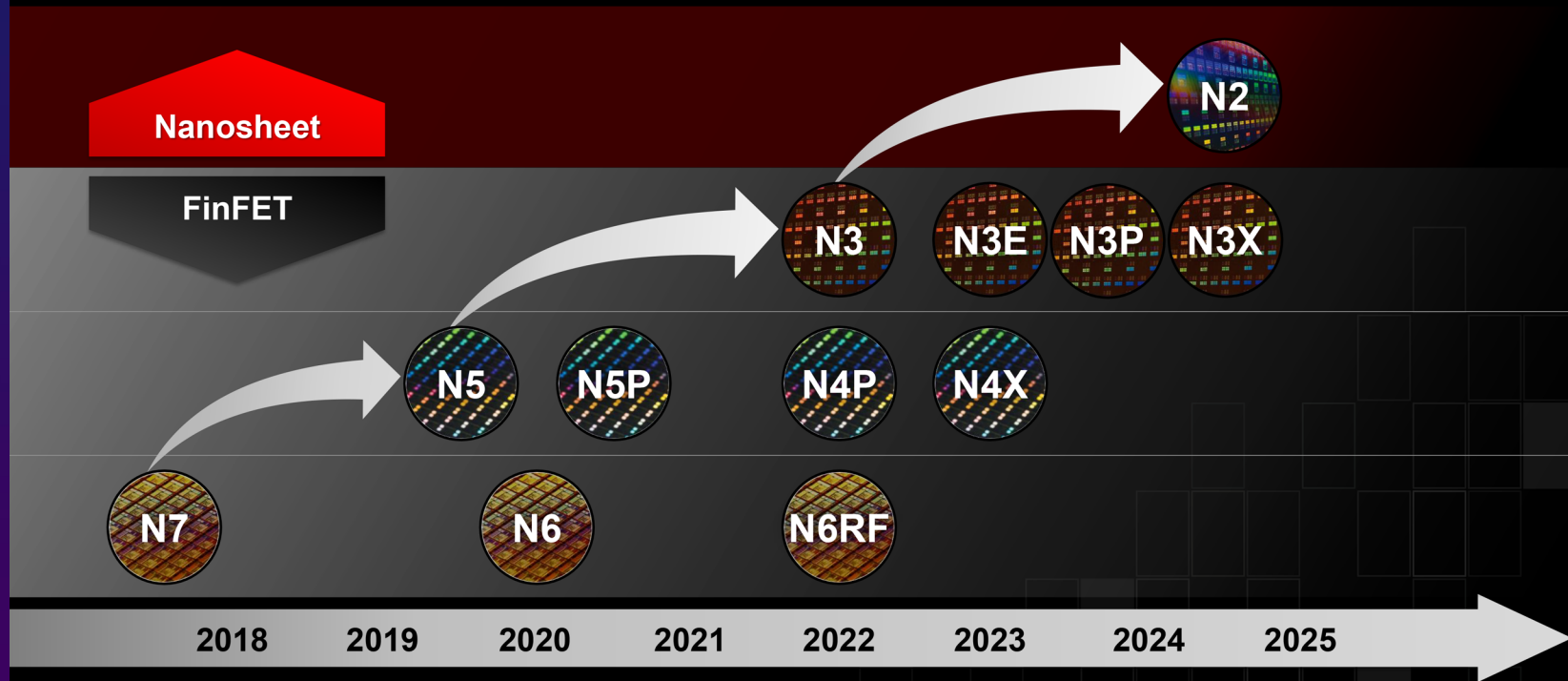


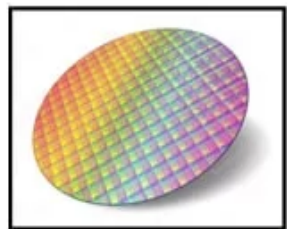
Technology roadmap

Industry-leading Advanced Technology Portfolio



Unleash Innovation

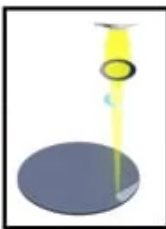




Start



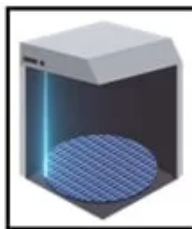
Oxidation



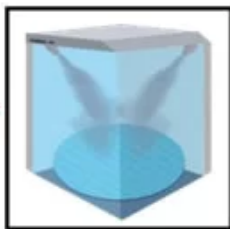
Photolithography



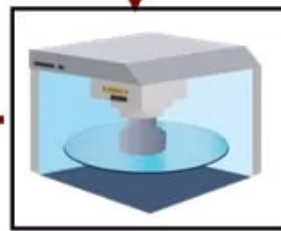
Etching



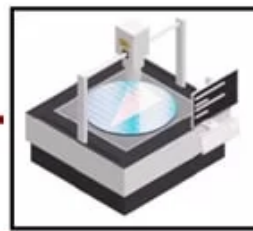
Implantation



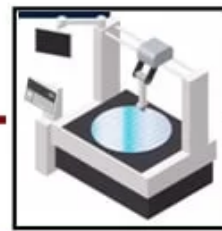
Metal Deposition



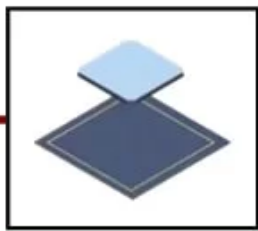
Polishing



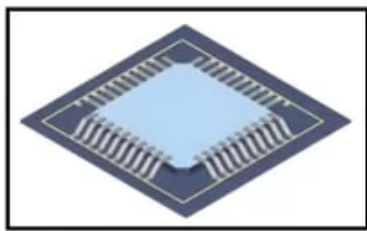
EDS



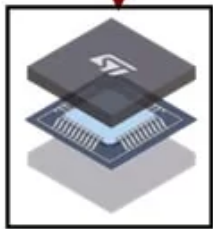
Dicing



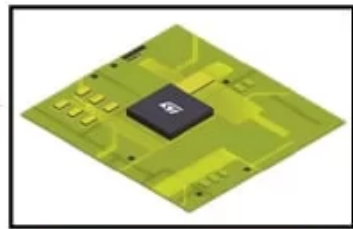
Die Attach



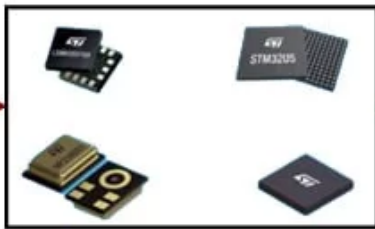
Wire Bonding



Encapsulation



Testing



Packaging



Finish

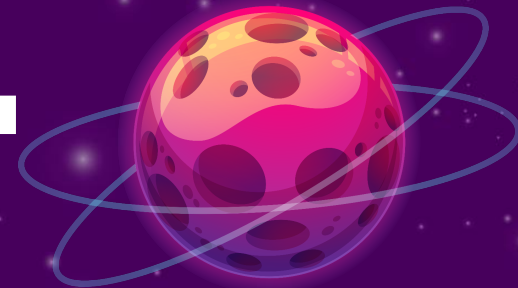
Wafer Fab Equipment (WFE)

Applied Materials \$25.79 billion 

KLA Corp \$9.21 billion 

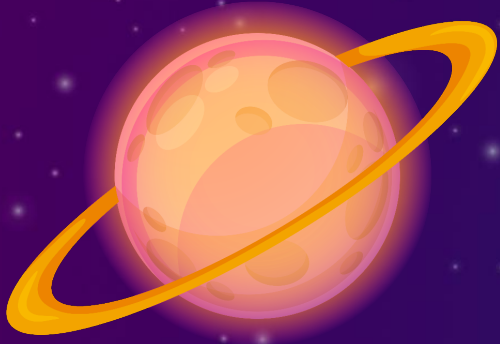
Lam Research \$17.23 billion 

Tokyo Electron \$16.37 billion 

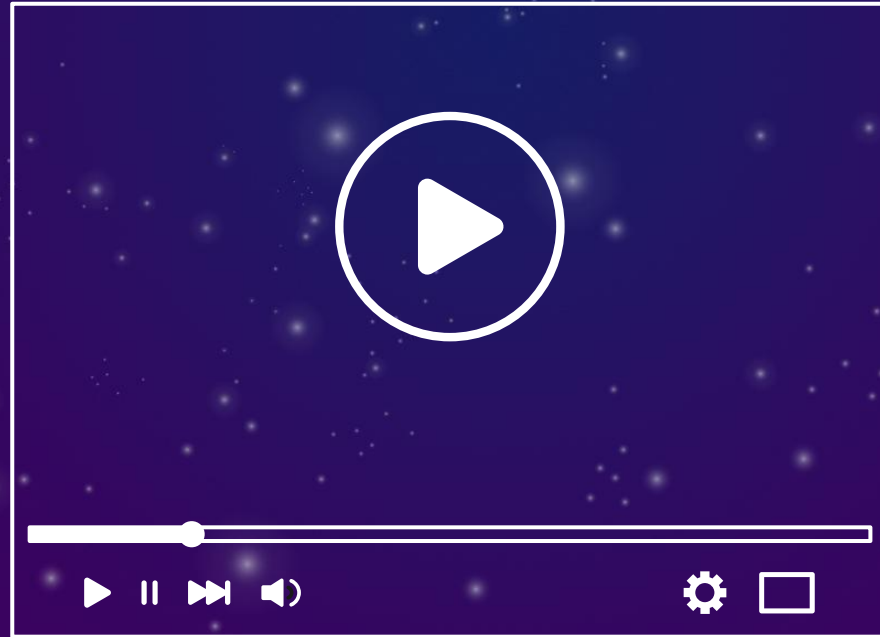


Number of Semiconductor Manufacturers with a Cutting Edge Logic Fab

SilTerra										
X-FAB										
Dongbu HiTek										
ADI	ADI									
Atmel	Atmel									
Rohm	Rohm									
Sanyo	Sanyo									
Mitsubishi	Mitsubishi									
ON	ON									
Hitachi	Hitachi									
Cypress	Cypress	Cypress								
SkyWater	SkyWater	SkyWater								
Sony	Sony	Sony								
Infineon	Infineon	Infineon								
Sharp	Sharp	Sharp								
Freescale	Freescale	Freescale								
Renesas (NEC)	Renesas	Renesas	Renesas	Renesas						
Toshiba	Toshiba	Toshiba	Toshiba	Toshiba						
Fujitsu	Fujitsu	Fujitsu	Fujitsu	Fujitsu						
TI	TI	TI	TI	TI						
Panasonic	Panasonic	Panasonic	Panasonic	Panasonic	Panasonic					
STMicroelectronics	STM	STM	STM	STM	STM					
HLMC	HLMC		HLMC	HLMC	HLMC					
IBM	IBM	IBM	IBM	IBM	IBM	IBM				
UMC	UMC	UMC	UMC	UMC	UMC		UMC			
SMIC	SMIC	SMIC	SMIC	SMIC	SMIC		SMIC			
AMD	AMD	AMD	GlobalFoundries	GF	GF	GF	GF			
Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung	Samsung
TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC	TSMC
Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel	Intel
180 nm	130 nm	90 nm	65 nm	45 nm/40 nm	32 nm/28 nm	22 nm/20 nm	16 nm/14 nm	10 nm	7 nm	5 nm



2022 / 2023



Russia



2022 Q3: chip exports to Russia plunged by 90%



Russia plans to build its own chip industry by investing \$44 billions



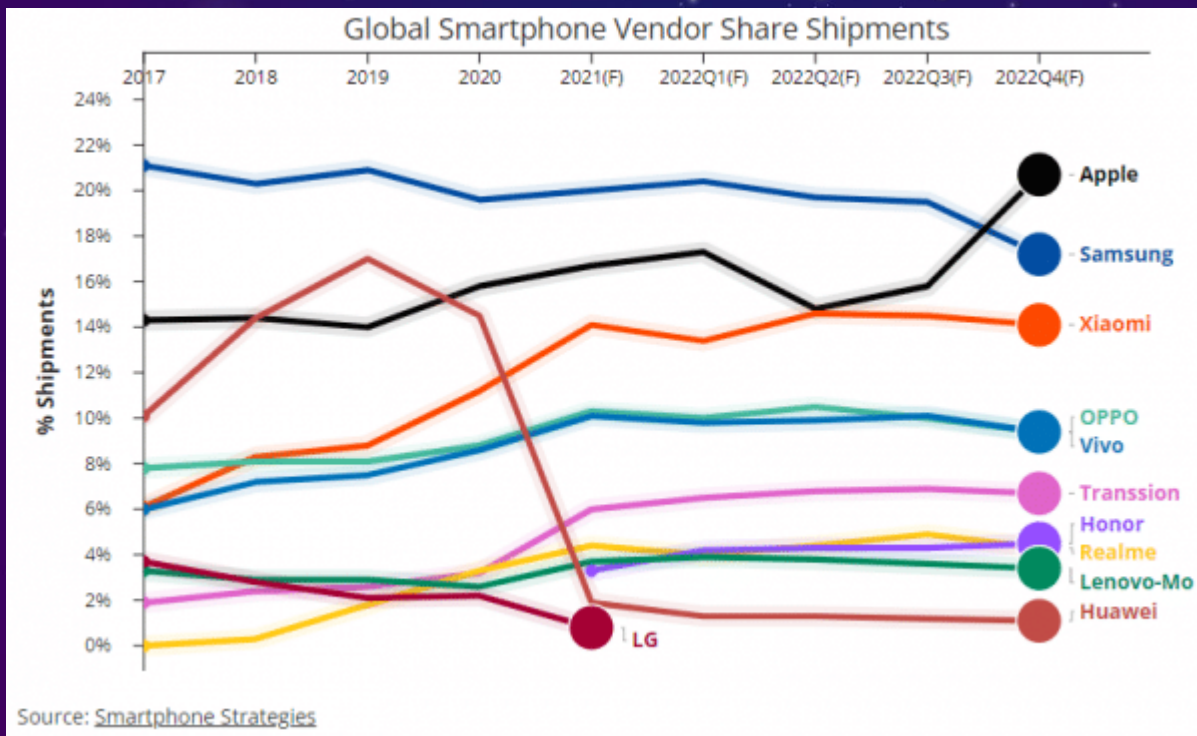
Smuggling (via Turkey, HK) brings its own problems

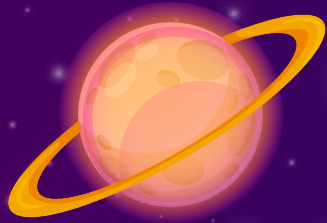


Chip purchases from China ?

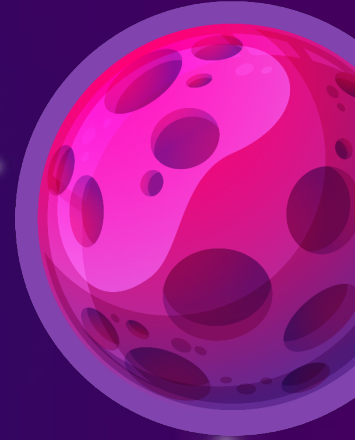


Huawei





HiSilicon



Kirin 9000: 8 cores + 24 cores GPU comparable to the Apple M1 Silicon manufactured by TSMC (5nm), Ascend 310 machine learning CPU, Kunpeng 920 24 core server CPU (TSMC 7nm)

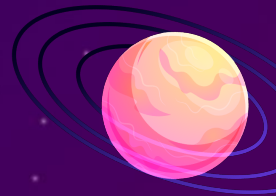


TSMC complied with US regulations stopping all shipments to HiSilicon in September 2020



HiSilicon reached 0% marketshare in Q2/Q3 2022 after consuming all its inventory

Intent to kill





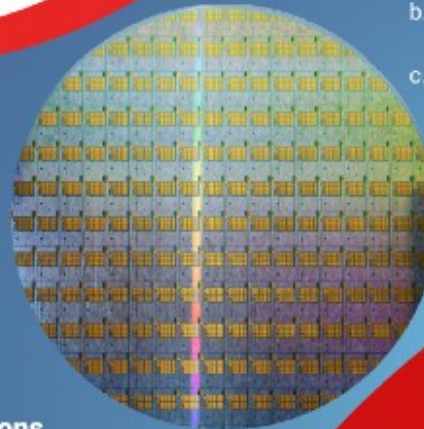
New U.S. policy of actively strangling large segments of the Chinese technology industry—strangling with an intent to kill.

Gregory C. Allen
Center for Strategic & International Studies
October 11, 2022



Restricts the supply of equipment and tools to any fab in China that manufactures/develops the following:

- a. Logic chips with non-planar transistor architectures (i.e., FinFET or GAAFET) of 16nm or 14nm, or below;
- b. DRAM memory chips of 18nm half-pitch or less;
- c. NAND flash memory chips with 128 layers or more.



Restricts the ability of US persons (including citizens, green card holders, and foreign nationals who live in the US) to support the development, or production, of ICs at China-based advanced semiconductor manufacturing fabs without a license



US Management Team

Dear US colleagues,

As you may have heard, on Friday, October 7, the US government issued a new set of regulations prohibiting support to certain fabs in China by US persons. As a result, ASML US employees - including US citizens, green card holders, and foreign nationals who live in the US - are prohibited from providing certain services to advanced fabs in China.

Effective [at midnight tonight](#), ASML US employees must refrain – either directly or indirectly - from servicing, shipping, or providing support to any customers in China until further notice, while ASML is actively assessing which particular fabs are affected by this restriction. If you have questions about how this may affect you or your team, please contact David Kim, Head of US Legal, or Steve Lita, Export Controls Manager.

We are working diligently to evaluate the new regulations and their impact on ASML. We will follow up with more information in the very near future.

Best regards,

On behalf of the [US Management Team](#)

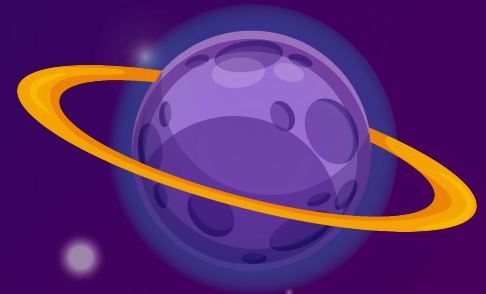
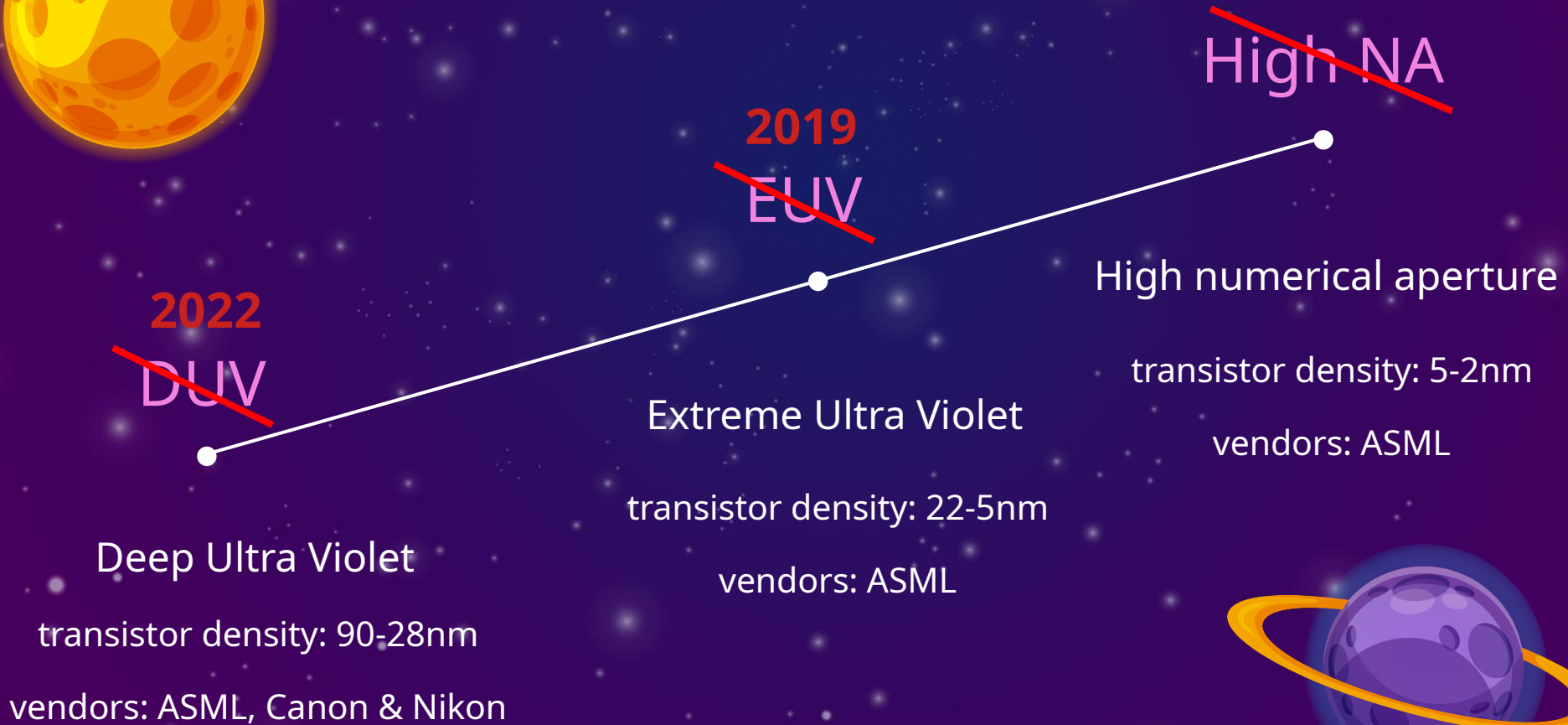
Yu Cao, USMT Chair

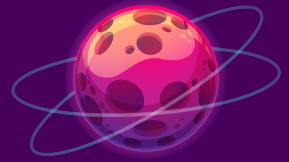
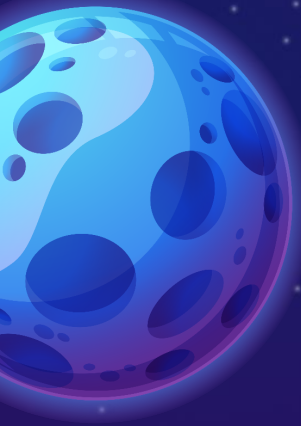
David Kim, USMT Vice Chair





Litho-sphere





Immediate aftermath



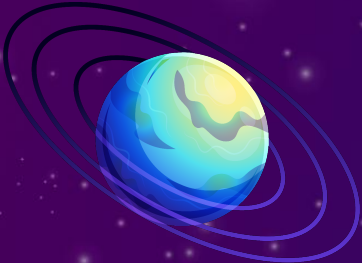
Applied Materials, Lam Research, Kla Corp, Tokyo Electron, ASML and many more immediately complied with the sanctions



2022 Q4: semiconductor equipment exports to China dropped (Japan 16%, USA 50% & Netherlands 44%)



2022 Q4: semiconductor exports to the rest of the world grew (Japan 26%, USA: 10%)



Yangtze Memory Technologies (YMTC)



6th largest maker of NAND flash (128 layers) with a global marketshare of ~5%

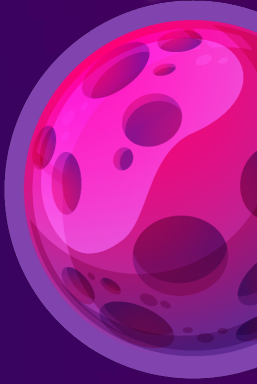


2020: start of construction of new fab aiming to triple production output



Apple was interested in a partnership for iPhone NAND Flash chip storage production

Yangtze Memory Technologies (YMTC)



October 2022: mass exodus of American passport holders employed by YMTC



January 2023: layoffs and new hirings frozen



Construction of new fab is on “pause”



By 2024 YMTC will have exited the NAND Flash business

Birentech



2019: founded in Shanghai



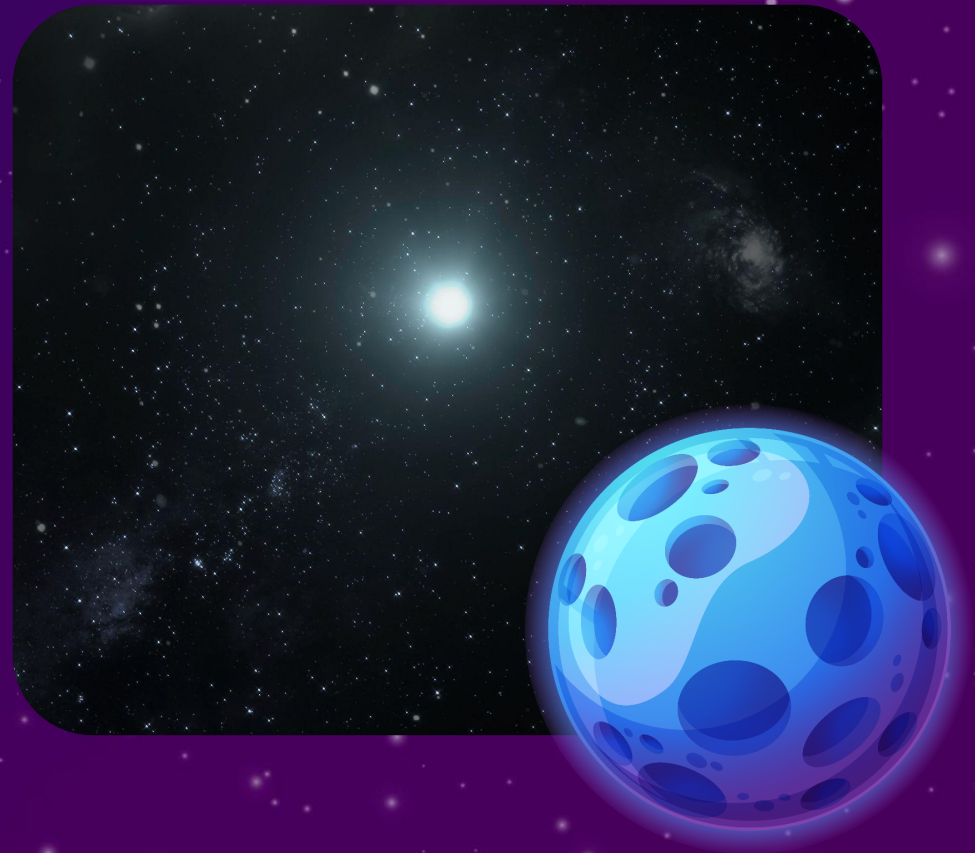
BR100: 77 Billion Transistors made with 7nm technology



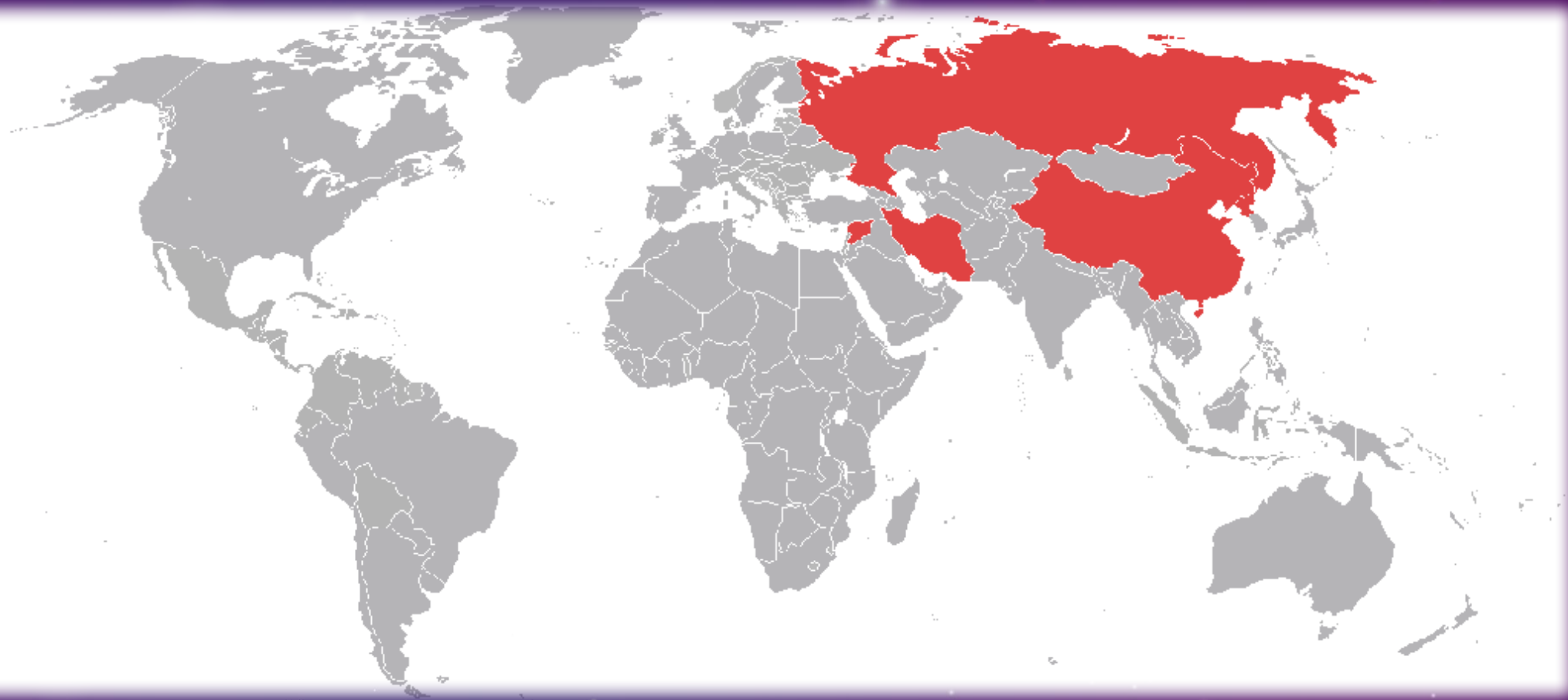
October 2022: TSMC "suspends" production



Outlook



Growing divide

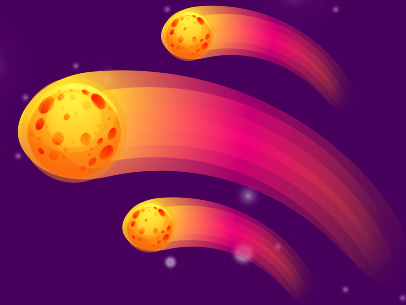


Japan is like Poland
the Philippines is like Romania
China is like Russia
Taiwan is Ukraine



Major General Joel Vowell
Commanding General, U.S. Army Japan
April 20, 2023

Defense of Japan 2022



Dec 2022: Japan announces 2023 defense budget of \$52 billion (26% rise year-on-year, largest increase since 1952)



“We have to protect Taiwan, as a democratic country”
- Yasuhide Nakayama (deputy defense minister)

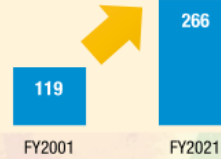


JSDF preparing to repel an invasion of remote home islands and/or Taiwan by 2025

Russia has been increasing military activities

Number of scrambles against Russian aircraft

Approx. 2.2 times



Deployed new equipment also in the Far East region



Steregushchiy-class frigates
Assigned to the Pacific Fleet in 2020

S-300V4 surface-to-air missile
Deployed in Etorofu and Kunashiri Islands in 2020

Northern Territories issue

North Korea's pursuit of nuclear weapons and missile capabilities

- First nuclear test in 2006 and a total of six nuclear tests thereafter
- Enhancement of missile technologies, including missiles with increasingly longer ranges and ones that fly on irregular trajectories



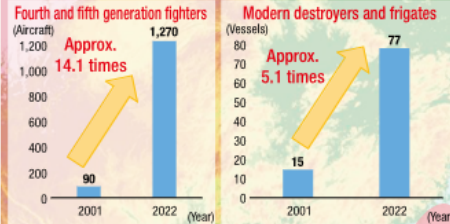
- Declared the completion of the nuclear force in 2017
- Continued systematic development of various weapons, including nuclear weapons

Issues concerning the Korean Peninsula

Active advancements to the Sea of Japan by China

Territorial disputes over Takeshima Island

China's broad and rapid change of military forces



China's attempt to change the status quo in the East China Sea / Rapid expansion and increase of military activities

Active advancements to the Pacific Ocean by China



Issues concerning Taiwan

Issues concerning the South China Sea

In the vicinity of Japan, moves toward strengthening military forces and increasing military activities are notable.



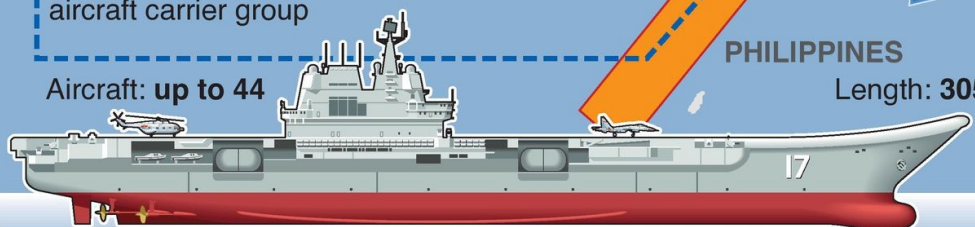


 Areas selected for
China naval exercises
 Major inspection routes

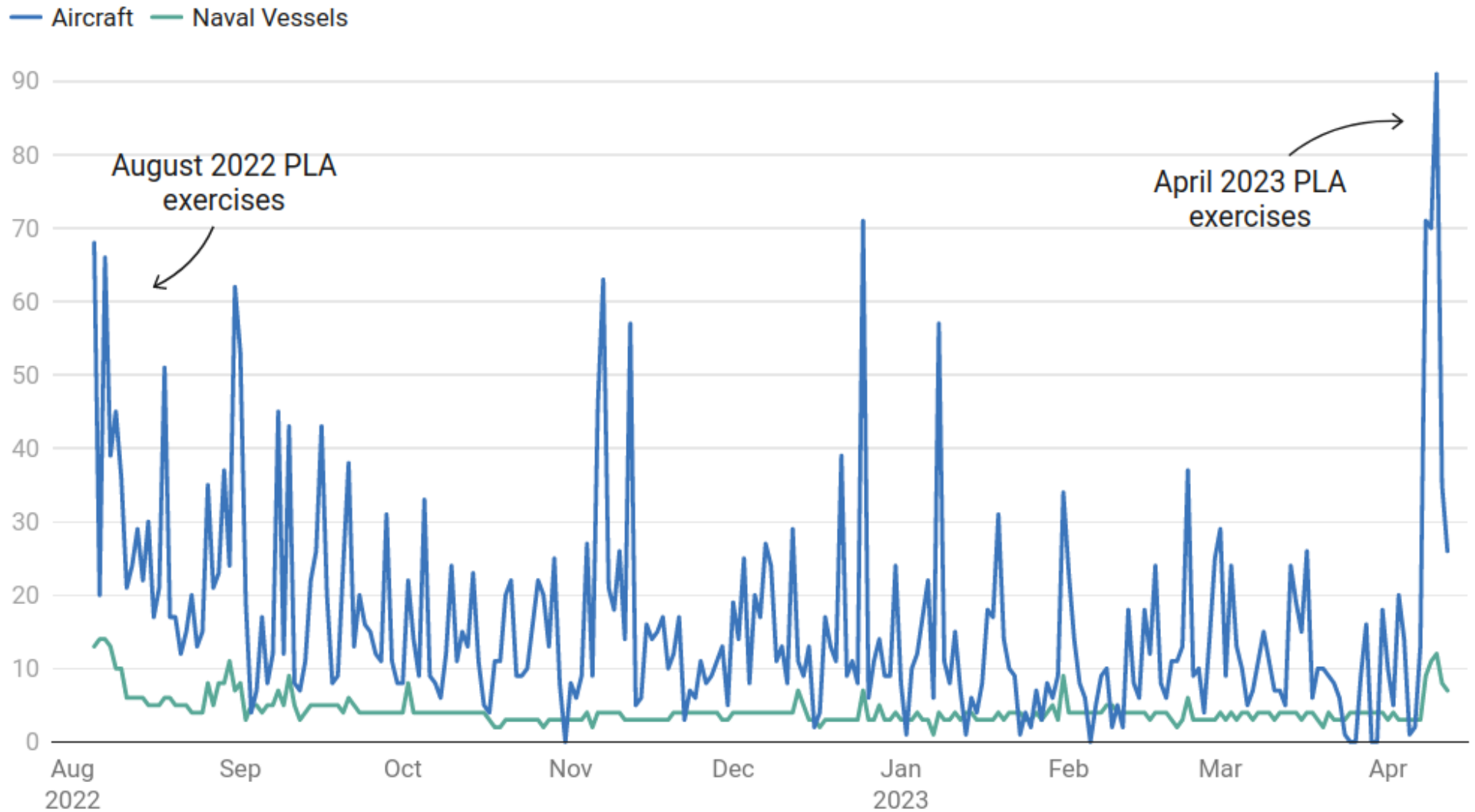
Taiwan Transport Ministry has
told shipping operators to
resist inspection orders
from China



100km
60 miles



Daily Number of PLA Aircraft and Naval Vessels around Taiwan





THANKS

Do you have any questions?

mareklindner@neomailbox.ch



Sources (I)

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[10] https://en.wikipedia.org/wiki/Transistor_count

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<https://asia.nikkei.com/Spotlight/The-Big-Story/China-s-chip-industry-fights-to-survive-U.S.-tech-crackdown>

