mercury

# THE EVOLUTION OF MOORE'S LAW THROUGH CHIPLETIZED ARCHITECTURES

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*Microsystems Business*

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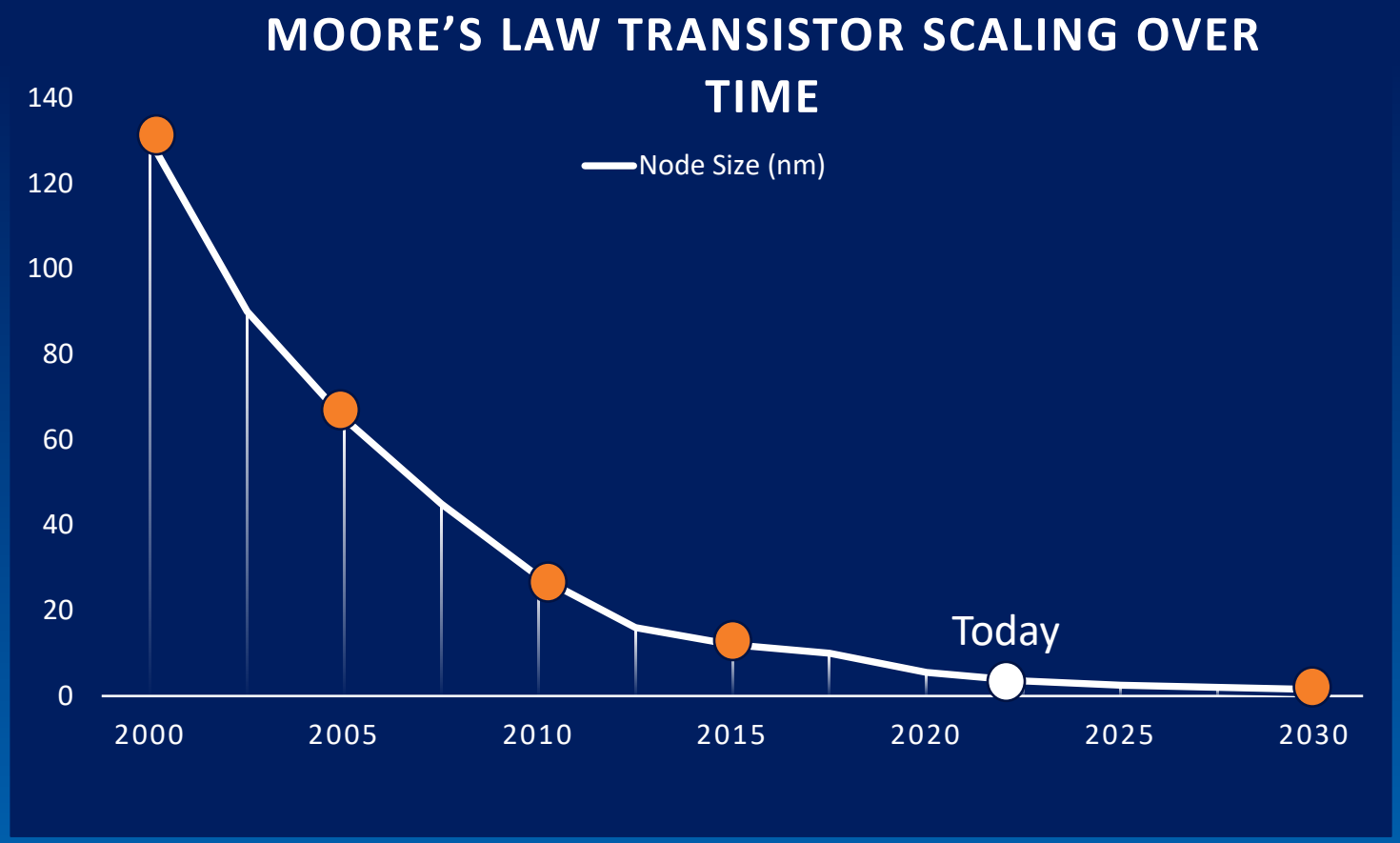
# Moore's Law

***We have left the transistor shrinking phase of Moore's Law***




## Moore's Law

- Doubling the number of transistors per chip roughly every two years

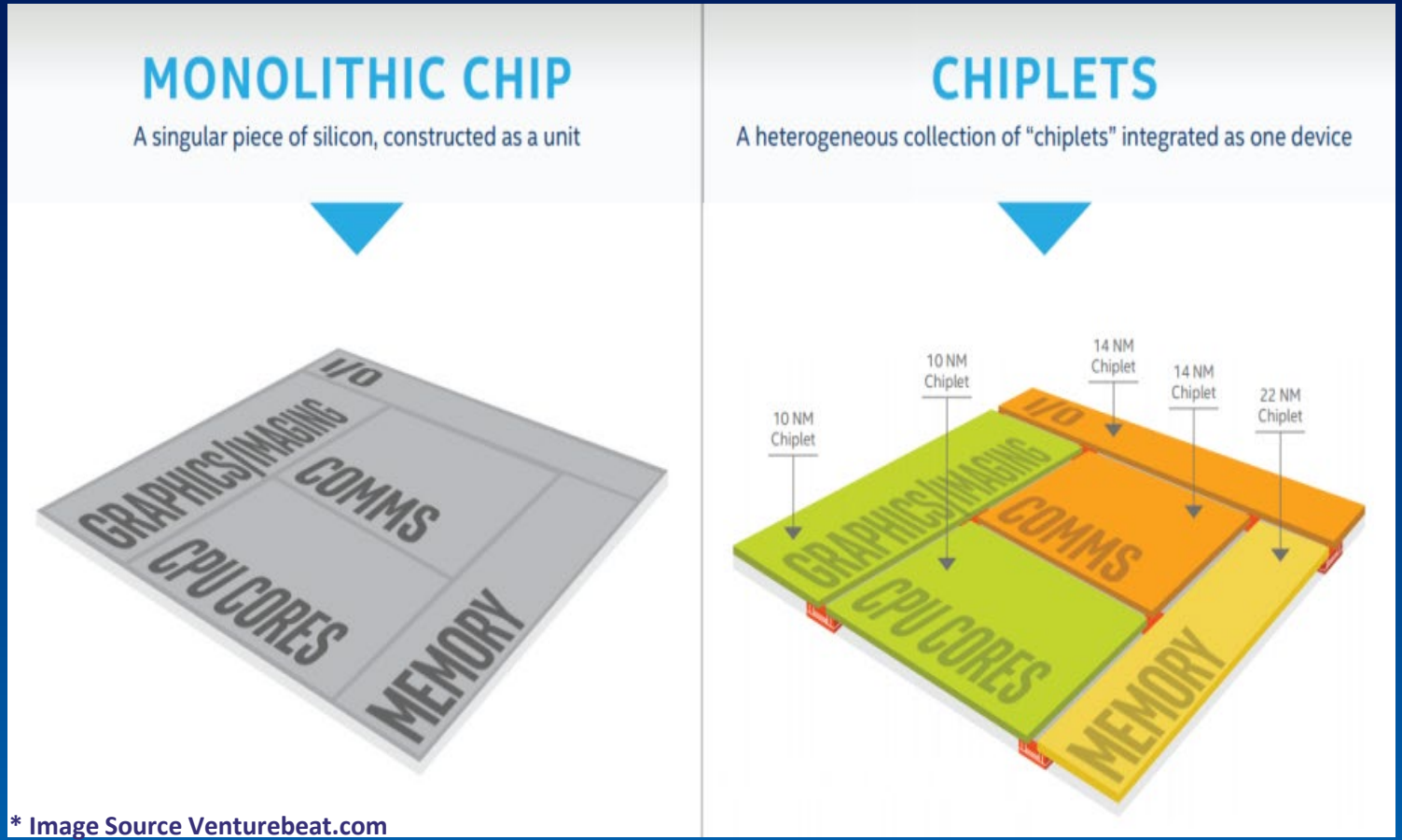
## Future of Moore's Law

- Increasingly difficult to maintain exponential improvements
  - R&D and capital investments
  - Cost of transistors (design, verification, test, and fabrication)
  - As transistor's shrink, performance trade-offs between analog and digital are increasing
- Chipletized architectures allow the focus on the right node for the specific capability

…and we have entered the next phase of Moore's Law through chipletized architectures

# The future of Moore's Law looks promising with chipletized architectures

- Moore predicted chipletized architectures as the next phase on his last page
- High speed chip-to-chip communications (AIB & UCIe)
- Enables mixed foundries, process nodes, and IP sources
- Specialized System in Packages (SiP)
- Leading semiconductor companies are already moving to heterogeneous 2.5D solutions




* Image Source Venturebeat.com

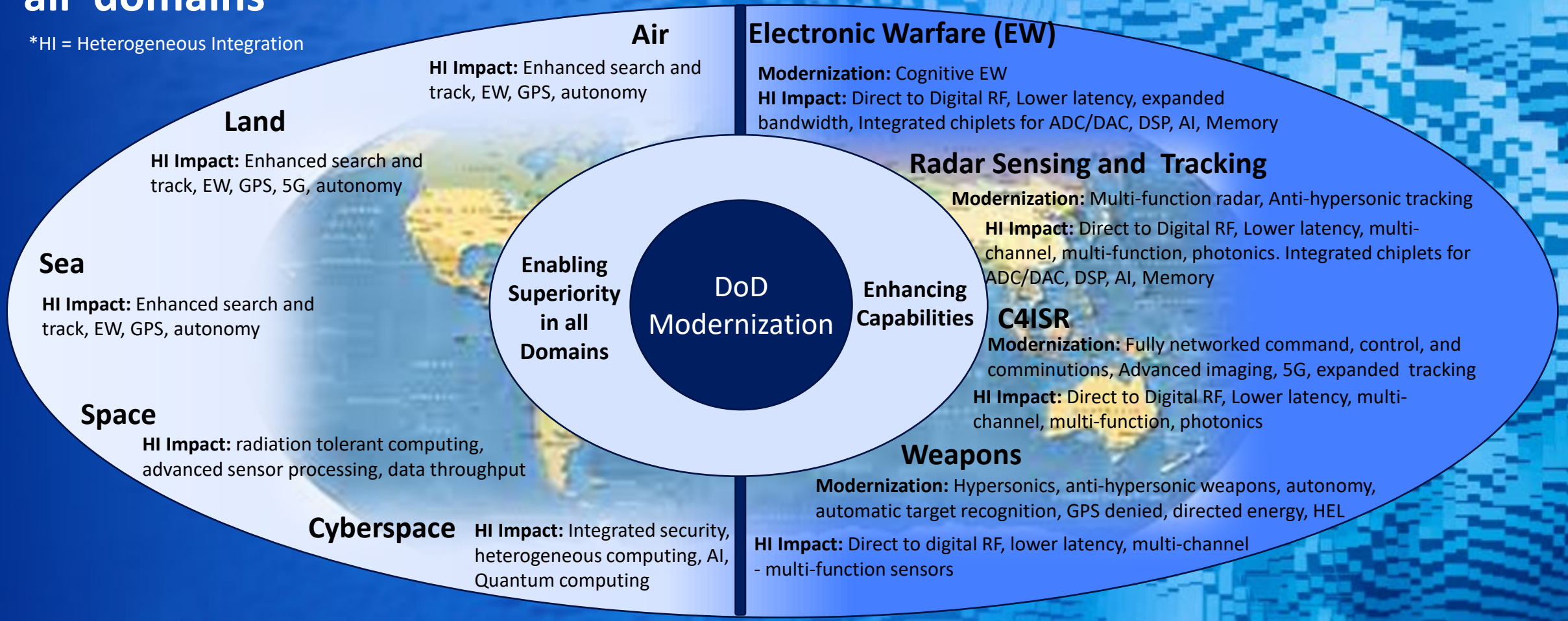
# Geopolitical and supply chain constraints are also impacting Moore's Law

- Globalization has migrated Advanced Packaging to the Pacific Rim for decades
- Current geopolitics is driving instability in the region and increasing the risk of access to leading edge microelectronics and packaging capabilities
- This has created substantial risks to western countries as they strategically modernize
- At the same time, Advanced Packaging is more critical in solutions as we transition to Heterogeneous Integrated (HI) architectures enabling processing to move to the sensor edge


Mercury Systems is focused on reshoring Advanced Packaging for critical microelectronics

# Result: Chipletized architectures enables modernization programs across all domains

*HI = Heterogeneous Integration



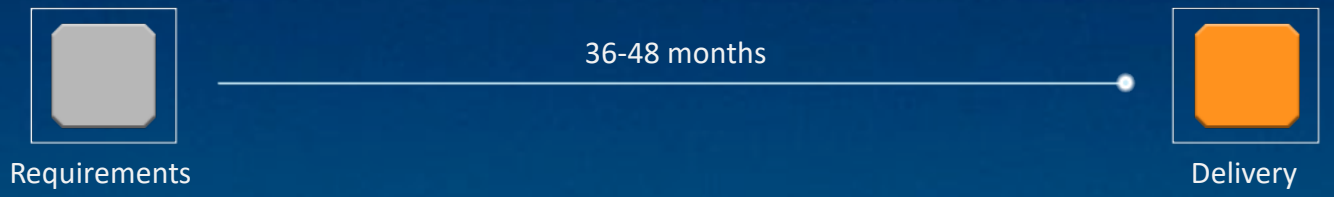

- Trusted, secure, and available advanced microsystems are critical in the modernization efforts
- Advanced HI packaging solutions are a key enabler for modernization activities

# Chiplet Technology –Bringing System Scale Down To Chip Scale

Mercury is uniquely positioned to lead the technology transfer from Silicon Valley to Aerospace and Defense because of our close collaboration with leading companies in the semiconductor industry.

We are a leading innovator in game-changing chiplet technology, expanding our trusted microelectronics capabilities to bring open systems architectures down to chip scale to push processing to the edge.

## Traditional Monolithic Chip Delivery Cycle




## New Accelerated Delivery Cycle

Chiplets enable multiple product updates in the same timeframe

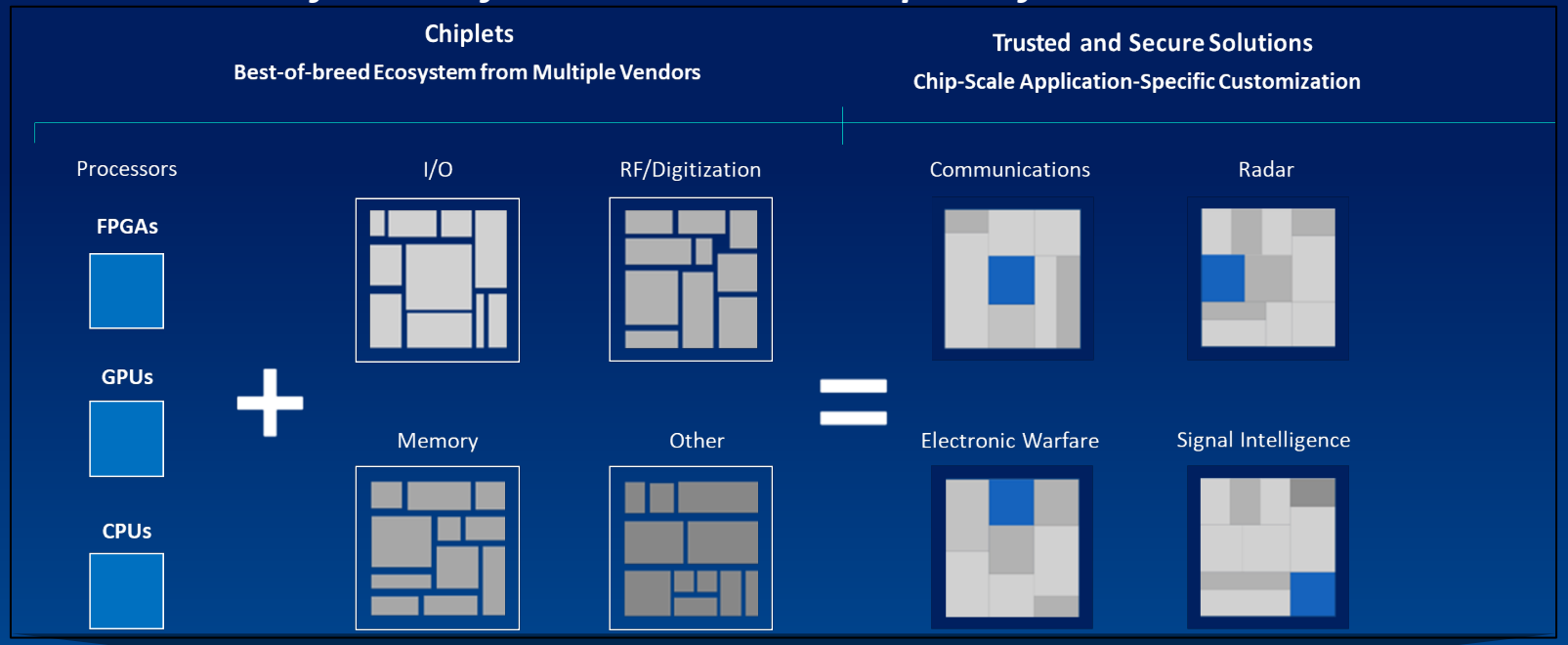

## Additional Benefits


Our capabilities

# Chiplet Architectures Enable New Applications at a Rapid Pace

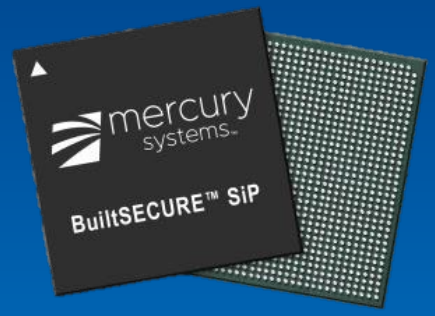
***Enabling customized and trusted leading-edge microelectronics for our defense customers at the speed of commercial innovation***

- **Defense Microelectronics is trending with:**
  - High frequency analog processing moving to digital semiconductor technologies
  - Much higher signal processing & compute density
  - Reduction in overall power required
  - Trusted manufacturing increasing in importance
  - Heterogeneous solutions with many high-value chiplet/die partners
  - Reduced time to system fielding
  - Less overall program spend
- **Mercury Microsystems is driving thought leadership in defense:**
  - Innovating 2.5/3D capabilities with compelling advantage over traditional methods
  - Maturing strong relationships with semiconductor partners
  - Increasing the value chain for fully integrated sensor edge processing solutions
  - Open Systems Architecture (OSA) at chip-scale enabling modularity and flexibility.
  - Future: Mercury designed chips and chiplets

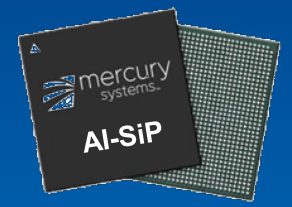




***Signal Processing at Sensor Edge***



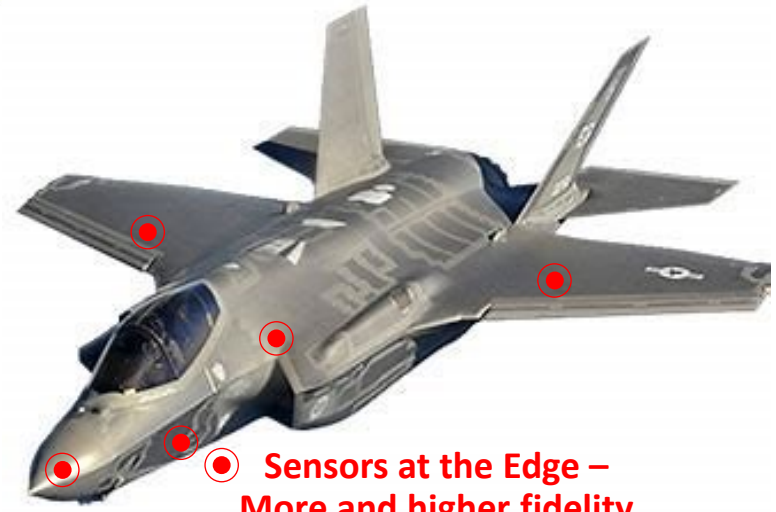

***Secure Processing at the Sensor Edge***




***Artificial Intelligence at the Sensor Edge***

# Mercury's 2.5D System in Packages

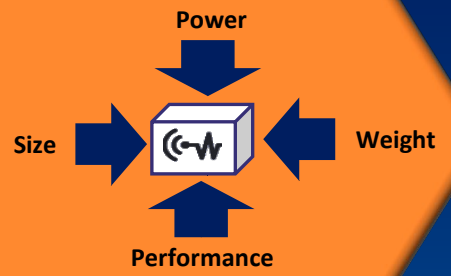
## Edge Processing Challenge

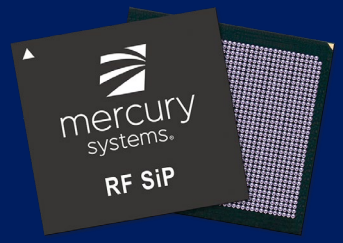


Sensors at the Edge – More and higher fidelity

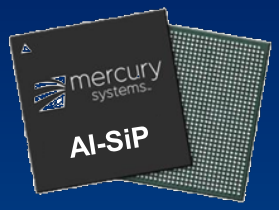
Disconnected from or limited bandwidth to Data Center Processing

## Sensor Processing Drivers

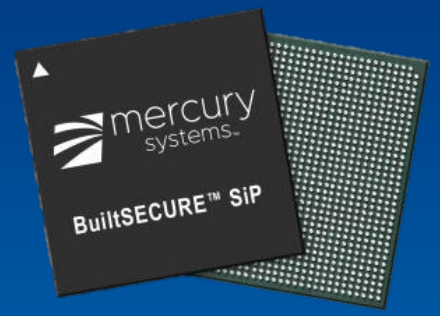



*Signal Processing at the Edge*




*Artificial Intelligence at the Edge*




*Secure Processing at the Edge*

## Enables Processing at the Sensor's Edge to Turn Data Into Information

# Mercury Vision: Chiplet Based Store Front

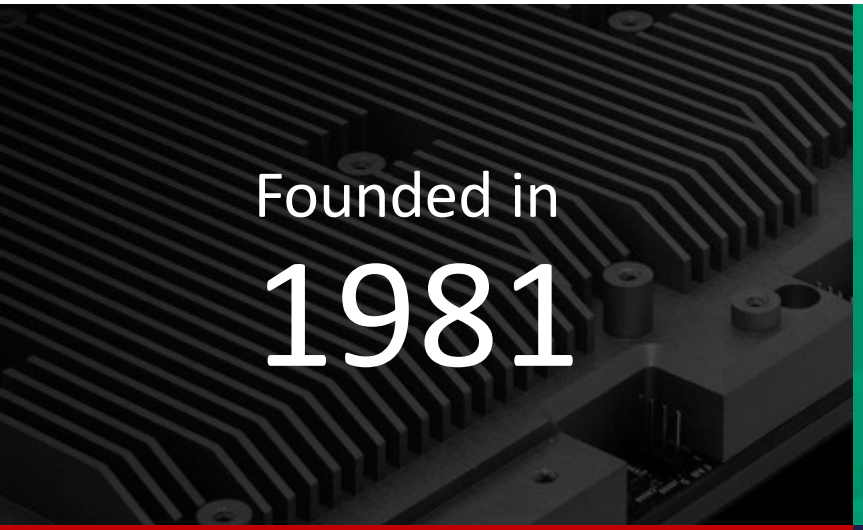
Mercury Store Front

- ITAR
- DFAR contracts
- Trusted design and processes
- Classified design and/or processes
- Security
- Unique IP
- Unique processes
- Merchant supplier focused on DoD
- Merchant semiconductor partnerships
- Access to leading edge silicon
- Low-volume/high-mix production
- Rugged environments
- Integrated solutions (CCA & subsystem level)

| | | |
|---|---|---|
| Standard Parts | Derivative Parts | Fully Custom Parts |
| Heterogeneous Chip/Chiplets Access/Library | Security IP Mercury Third Party Library | Customer Chip/Chiplets and/or Security IP |
| MIL-SPEC Environments | Program Modified Environments | Program Unique Environments |
| COTS Boards | Modified COTS Boards | Unique Form Factors and/or Integrated Subassemblies |

# Mercury Systems

## *Innovating in 2.5/3D chiplitized architectures for the Aerospace and Defense industry*



Founded in

1981

**Business model at the intersection of high-tech and defense**

**One of the largest commercial companies providing secure sensor and mission processing to the Defense industry**

PURPOSE-BUILT

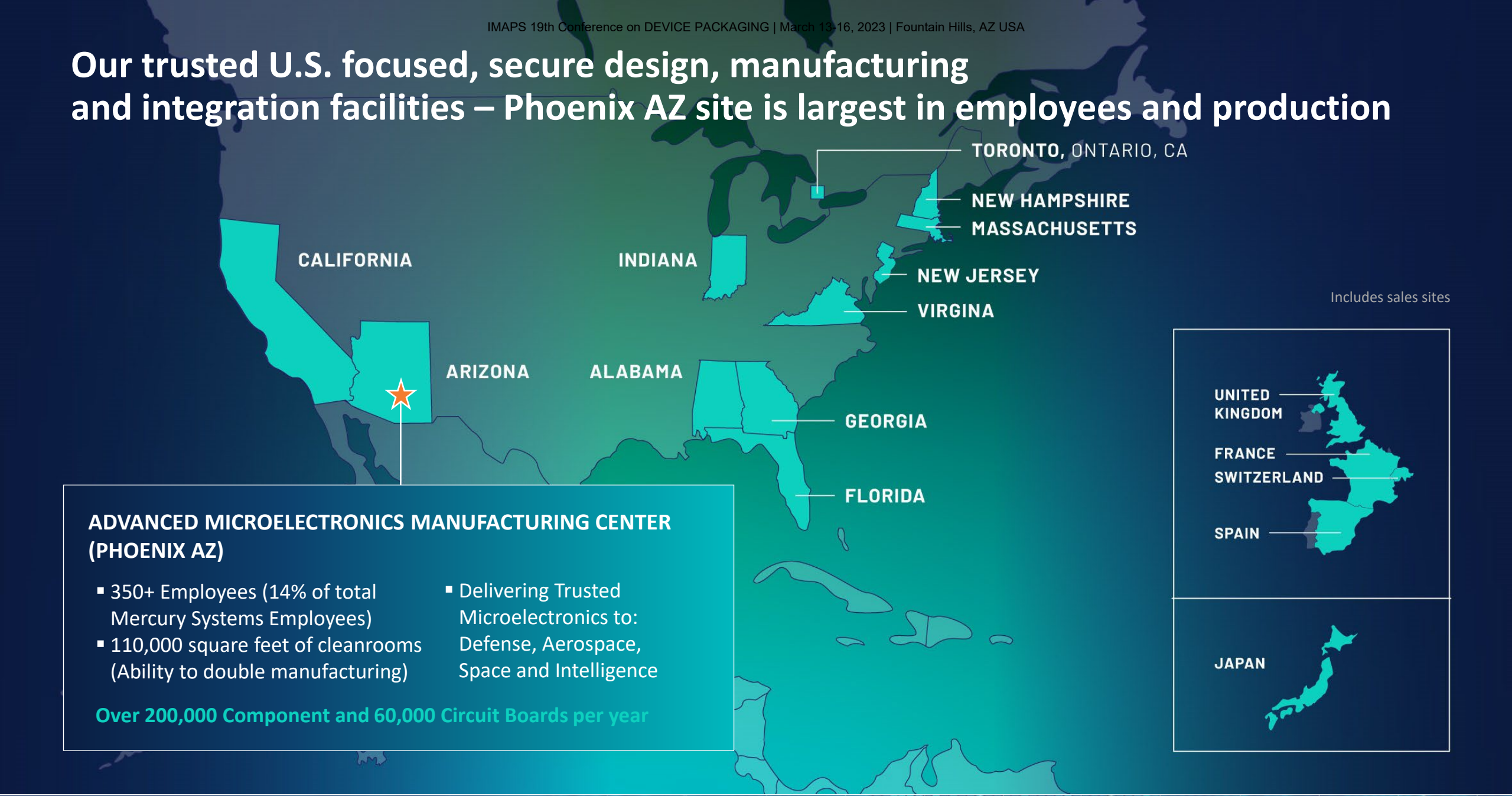
**Solutions purpose-built for all Aerospace & Defense customers**

**Making commercial technology profoundly more accessible**

NASDAQ: **MRCY**

**Publicly traded company since 1998**

# Our trusted U.S. focused, secure design, manufacturing and integration facilities – Phoenix AZ site is largest in employees and production




## ADVANCED MICROELECTRONICS MANUFACTURING CENTER (PHOENIX AZ)

- 350+ Employees (14% of total Mercury Systems Employees)
- 110,000 square feet of cleanrooms (Ability to double manufacturing)
- Delivering Trusted Microelectronics to: Defense, Aerospace, Space and Intelligence

**Over 200,000 Component and 60,000 Circuit Boards per year**

# Mercury solutions deployed on 300+ programs with 25+ primes

## Aerospace & Defense Platform and Systems Electronics Content

### C4I

JLTV

Subsurface Fleet

BLACKHAWK

A330 MRTT

Aegis

### Sensor & Effector Mission Systems

F-16

Reaper/Gorgon Stare

Triton

LTAMDS

Aegis

F-35

C-130

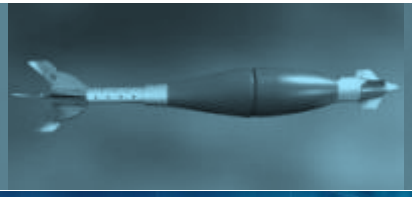
Global Hawk

Badger/Buzzard

SEWIP

Stormbreaker

PGK



MALD-J

Paveway

SM2/3/6

### Primes

- AIRBUS
- BAE SYSTEMS
- BOEING
- GENERAL ATOMICS
- L3HARRIS
- LEONARDO
- LOCKHEED MARTIN
- NORTHROP GRUMMAN
- RAYTHEON TECHNOLOGIES
- SAIC
- SIERRA NEVADA
- THALES

# Mercury Capabilities

- Trusted, on-shore manufacturing
  - AS9100, DMEA, Proven experience focused on A&D
  - Cleared facility and workforce
- On-site engineering for technology agility and acceleration
  - Full design including signal and power integrity engineering for high-density integration
  - Mechanical, thermal and process engineering
  - Custom-designed silicon interposer substrate
  - Ideal for harsh environments from gun-hardening to space
- Full solution and lifecycle support

# Chipletized Architectures Are the Future, But Before We Get There….

## Challenges & Opportunities

### Mature Chiplet Ecosystem

Industry should continue to work towards standardization of chip-to-chip communications to enable sustainable business model

### Onshore Access to State-of-the-Art Interposers & Substrates

Build up onshore manufacturers that can support lower volumes and high mix for the DoD while reducing cycling time

### Process Design Kit for Package Assembly

Automated tools for customers to select from a library of chiplets to create producible System in Packages (SiPs)

### Device Enablement & Support

Sustainable business model that supports diversity of chipletized architectures for different consumers

.