

# Kickstarting Non-Stop Innovation

## *Semiconductor Ecosystem Toolbox for Industry-Academia-Government*

Dr. Ashwini K Aggarwal

Director-Government Affairs, Applied Materials & Past Chair - IESA

IESA Vision Summit, 19/Oct/21

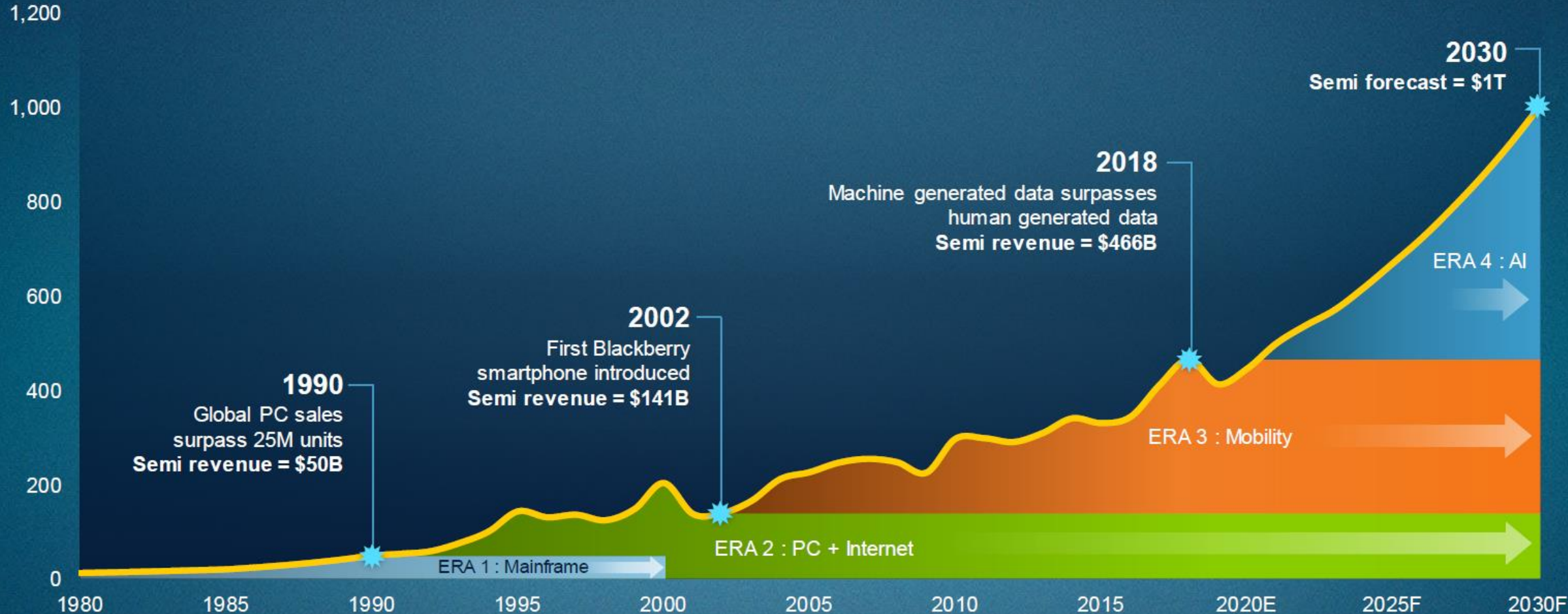




**We're at the dawn of the  
next industrial revolution.**



# Semiconductor Industry Revenue (\$B)



AI ERA WILL BE BIGGEST AGE OF COMPUTING





**Hyperconnectivity**



**Hypercompetition**



**“The old industrial platform  
is collapsing”**

MARTY NEUMEIER



**NO BUSINESS IS SAFE FROM DISRUPTION**

**HOW DO YOU THRIVE IN  
THIS KIND OF WORLD?**





# **Strategy or Culture?**



**“LET’S FIX THE NUMBERS FIRST AND  
WORRY ABOUT CULTURE LATER”**





# **CULTURE EATS STRATEGY FOR BREAKFAST**





**STRATEGY IS ABOUT INTENTION.  
CULTURE IS ABOUT HABIT.**



**CULTURE RESIDES IN THE  
HEARTS AND MINDS OF PEOPLE.**





# CULTURE IS BELIEFS AND VALUES



**CULTURE IS THE ENVIRONMENT IN  
WHICH YOUR BUSINESS THRIVES.  
OR WHERE IT DIES.**





# CULTURE INSPIRES INNOVATION



**Core of the Innovation!**



# We are Living in Exciting Times



IoT and Big Data



3D Printing



Personalized  
Medicine



EV and Energy Storage



Flexible Displays



Genomics



Robotics

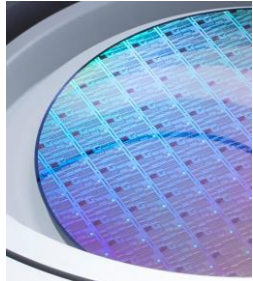


Drones

How can WE  
enable these  
inflections with  
**Smart**  
**technologies**  
FOR  
**Sustainable**  
**Growth?**

# Materials Engineering Enabling Global Inflections

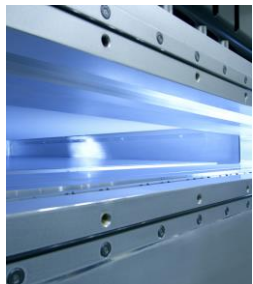
## — Applied's Core Businesses —



Semiconductor Systems



Applied Global Services



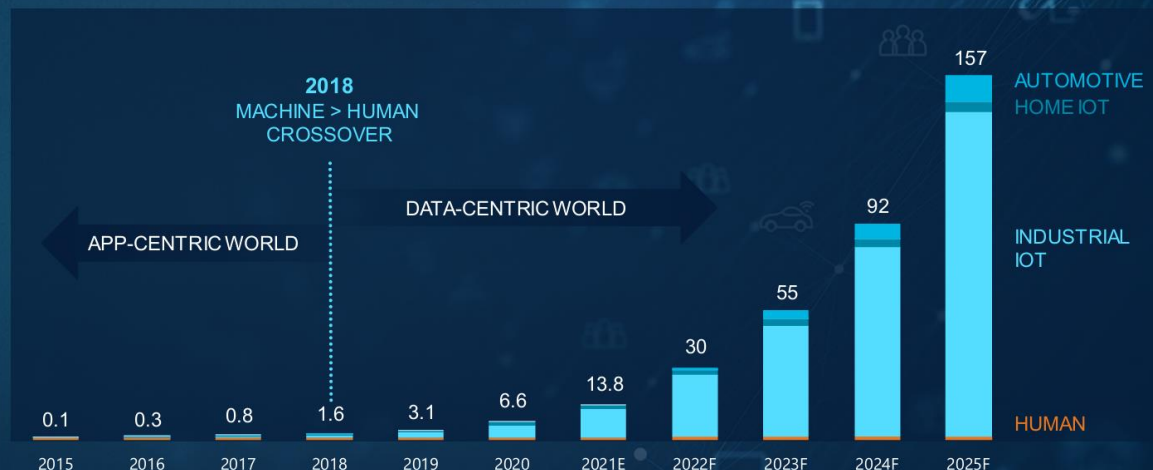
Display and Adjacent Markets

## — New & Adjacent Markets —

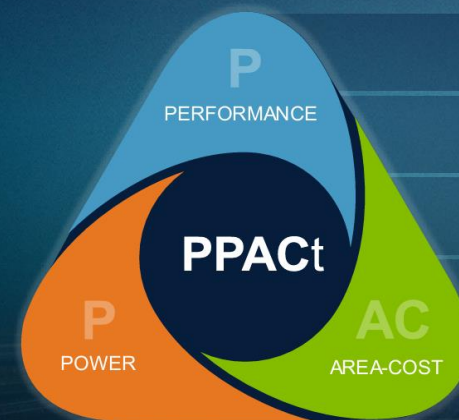




## Data Generation By Category (ZB)



SEMI GROWTH NO LONGER LIMITED BY HUMAN CONSUMPTION



ENABLED BY

- New architectures
- New structures / 3D
- New materials
- New ways to shrink
- Advanced packaging

Time-to-Market

NEW INDUSTRY PLAYBOOK  
FOUNDATION IS MATERIALS ENGINEERING

## THE MOST EXCITING

Industries on Earth

### WHAT WE DO

We make the **equipment** that makes the components that change the world.



## World's #1 semiconductor and display equipment company



**\$17.2 billion**  
revenue



**\$2.2 billion**  
R&D spending



**>13,000**  
patents



**AMAT** stock  
listing on  
NASDAQ



Headquartered  
in California's  
**Silicon Valley**



**~19,000** employees  
**91** locations  
in **18** countries

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# Applied Materials at IIT Bombay

**Benchmark**  
**Academia – Industry partnership**

CLEA  
2011

INUP & NCPRE  
2010

CEN, and Sponsored  
Research  
2006



Exploration Center

“Applied Materials’ visionary initiatives, continued investments and collaborations at IIT-Bombay have established a global benchmark in industry-academia partnerships; and enabled key developments for next generation nano-manufacturing solutions. Applied Materials is IIT Bombay’s foremost industry partner.”

Dr Devang Khakhar  
Director, IIT Bombay

Now with:  
IIT Kanpur, IIT Delhi, IIT Chennai, IISc Bglre, IIIT  
Hyd...



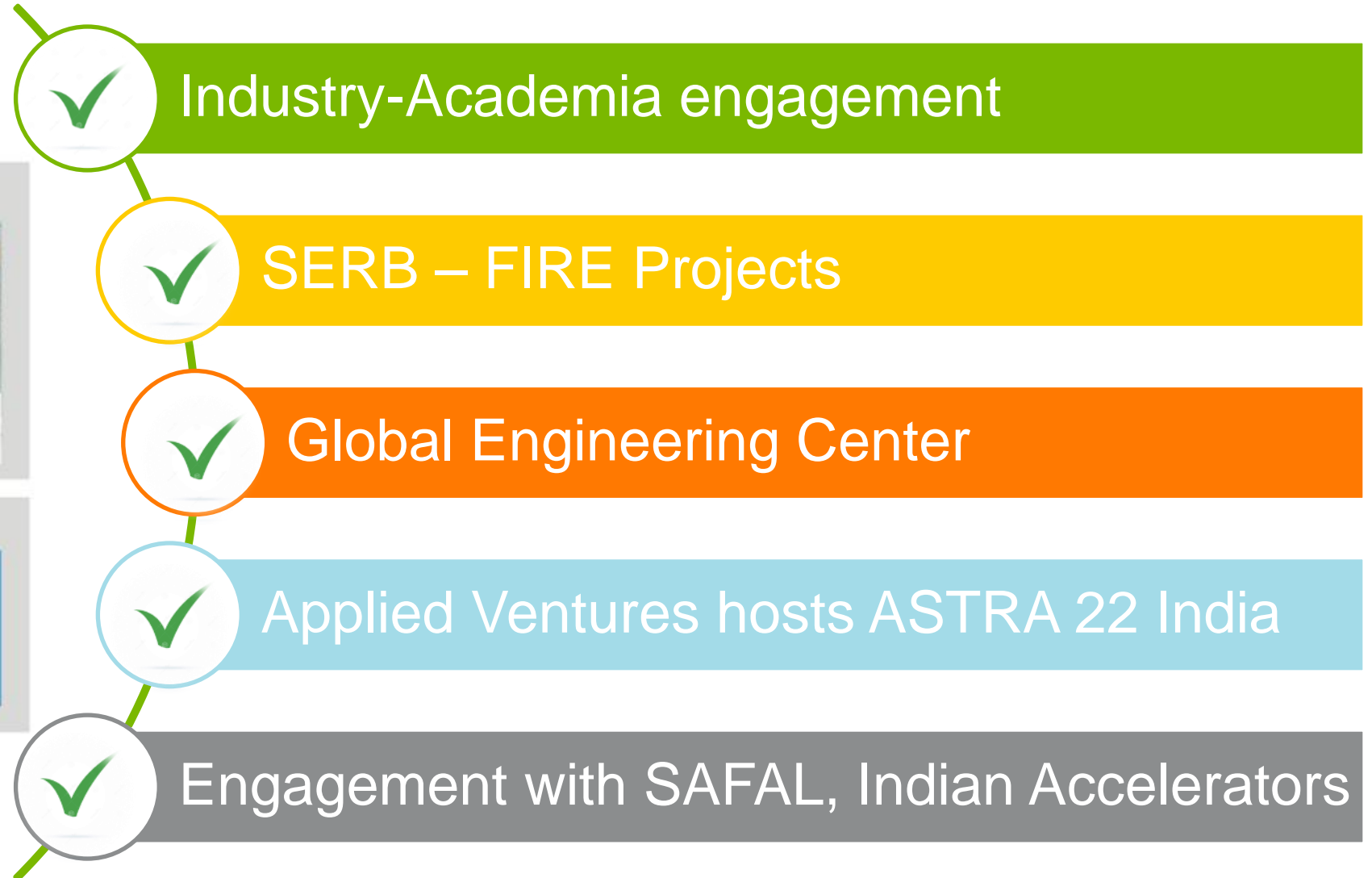
– PPP of Indian

s (>75

Master Certification Course launched  
(Sep’12) – Workforce Development

## Capacity Building for Semiconductor Ecosystem

# Capacity Building for Semiconductor Ecosystem





# ICAPS

IoT

Comms

Auto

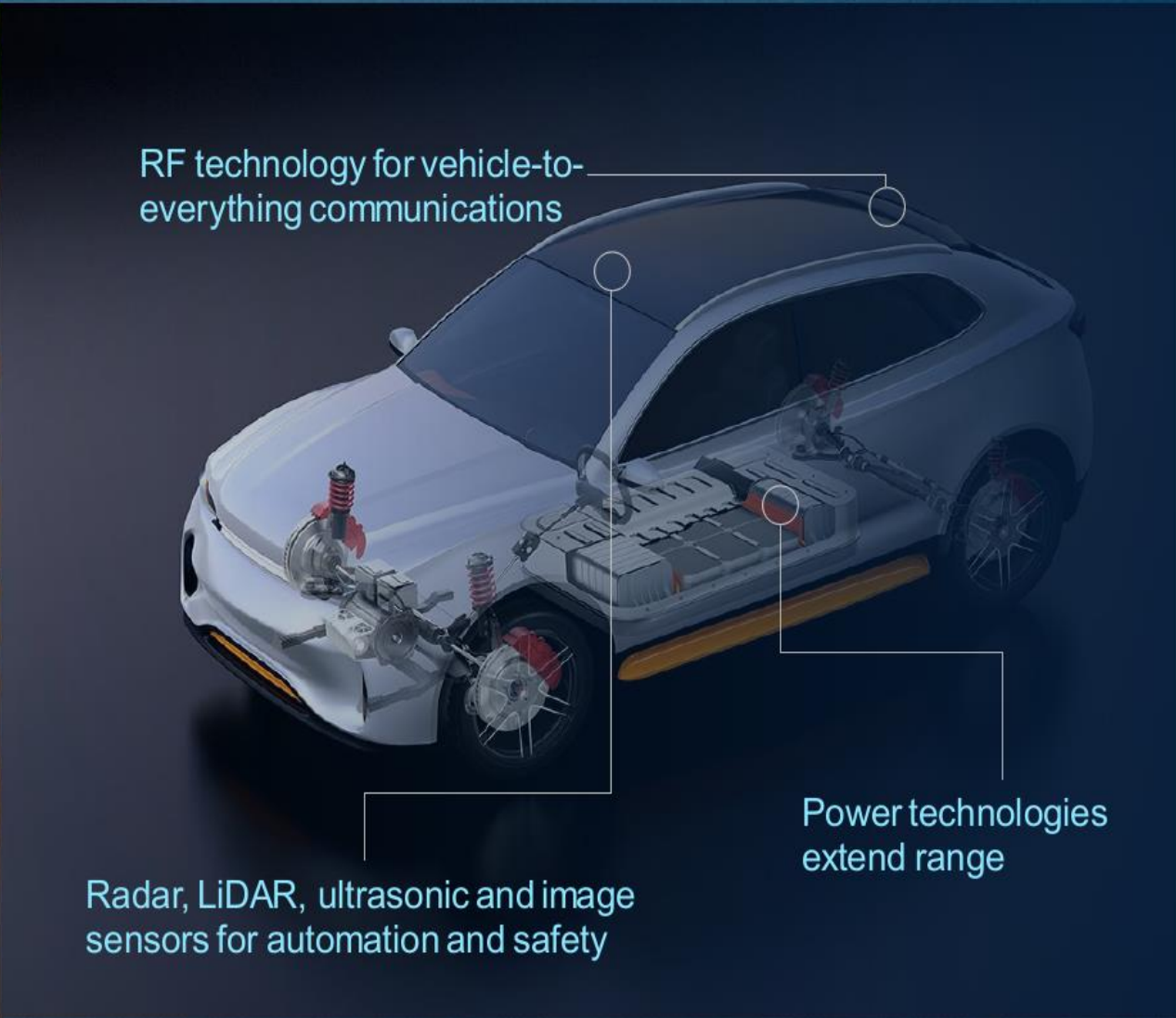
Power

Sensor

## Another Market Inflexion...



# Innovative ICAPS Technologies Transforming the Edge

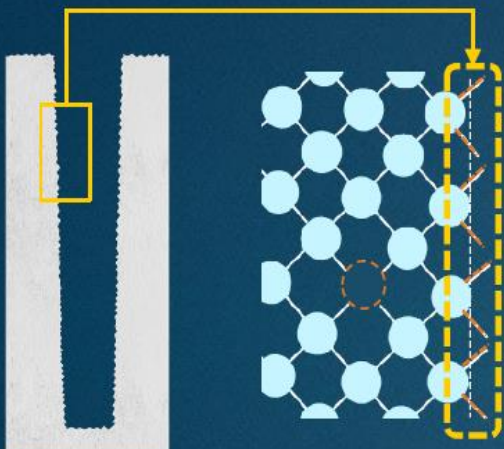




# Reducing Pixel Noise with Surface Engineering

## High-value problem

Defect sites at the pixel surface are sources of pixel noise



$$SNR \sim \frac{\text{Signal Sensitivity}}{\text{Pixel Noise} \sim i_{dc}}$$

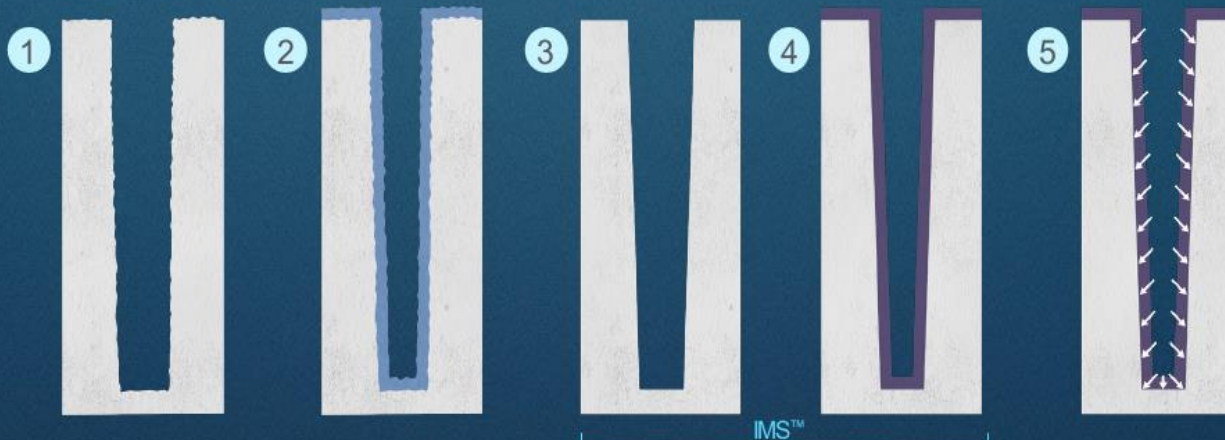
## Solution

Low-damage etch followed by silicon regrowth with embedded charge sites for defect passivation

### DTI surface engineering module

- 1 Lower damage silicon etch
- 2 Sidewall oxidation consumes damage layer
- 3 Selective removal of oxide
- 4 Doped epitaxial silicon regrowth
- 5 Millisecond anneal embeds passivating charges

### Device value SNR



### Products co-optimized

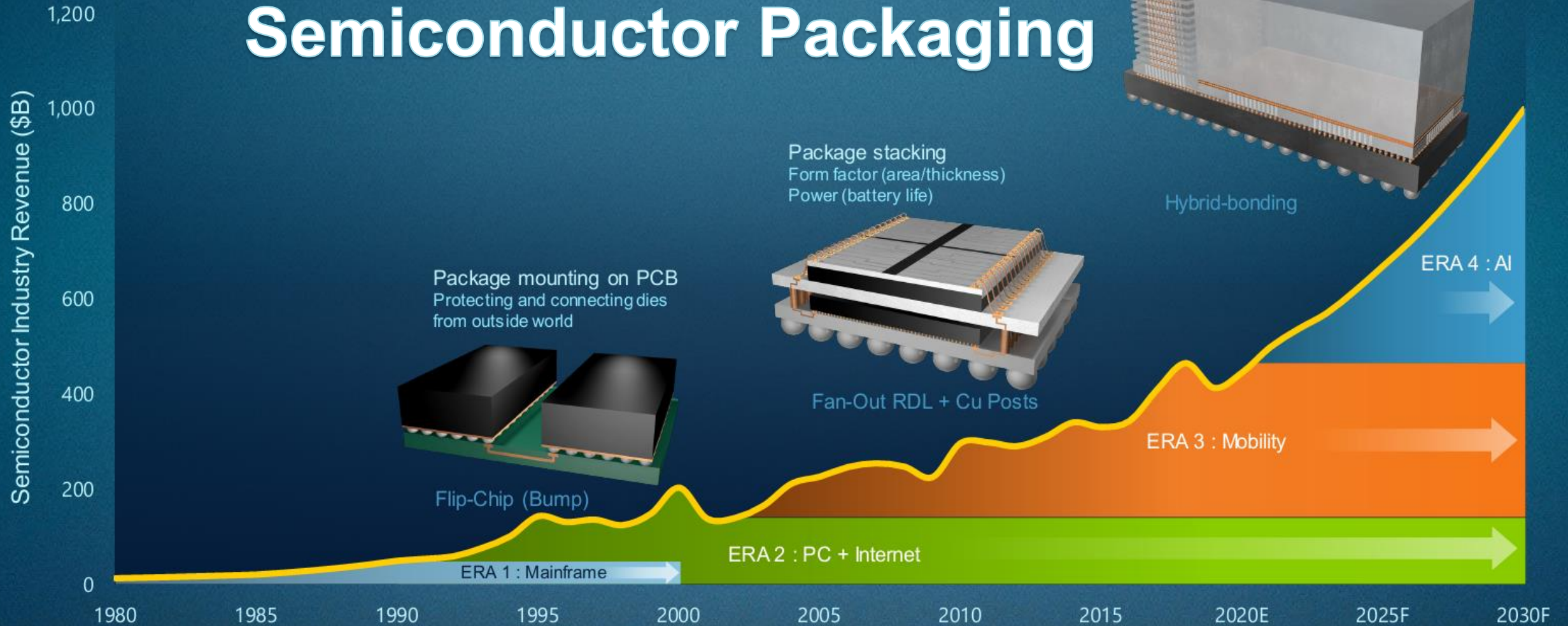
Centris® Sym3® Via Etch  
Centura® RPO  
Centura® RP Epi with Siconi®  
Vantage® Astra® DSA



# BIGGEST

*Computing Wave Yet*

## Semiconductor Packaging





# Organized to Address Packaging Challenges

Unit process  
leadership and  
broadest portfolio



Focus on enabling  
valuable inflections



Co-optimized  
technologies



Metal  
Deposition



Dielectric  
Deposition



Plating



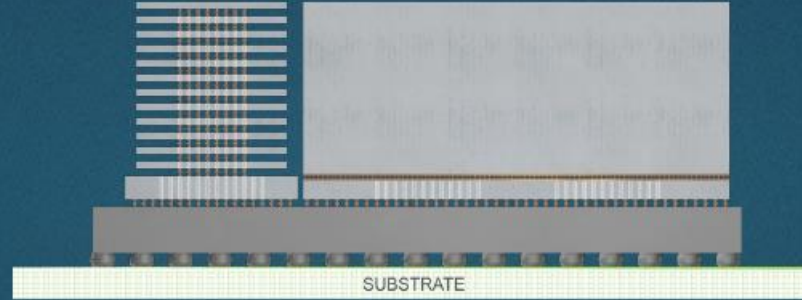
Etch



Planarization



Inspection

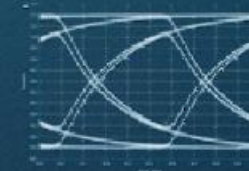


Heterogeneous Integration

Advanced Substrates



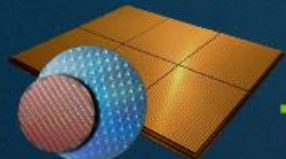
Dedicated advanced packaging lab



Package modeling



Test vehicles



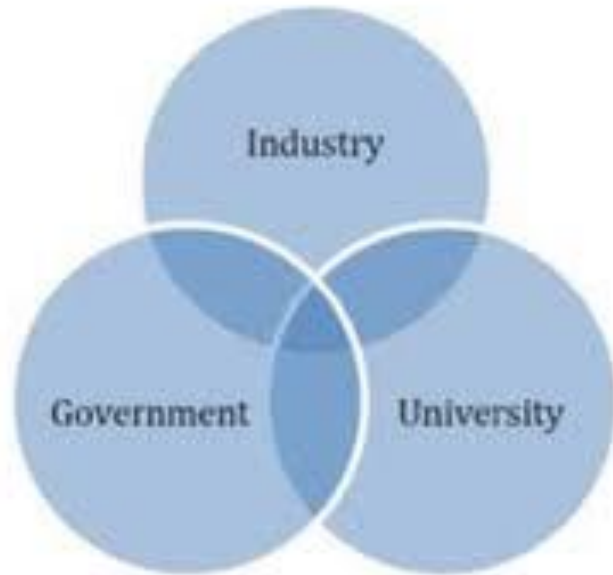
Wafer  
and Panel



Partnerships

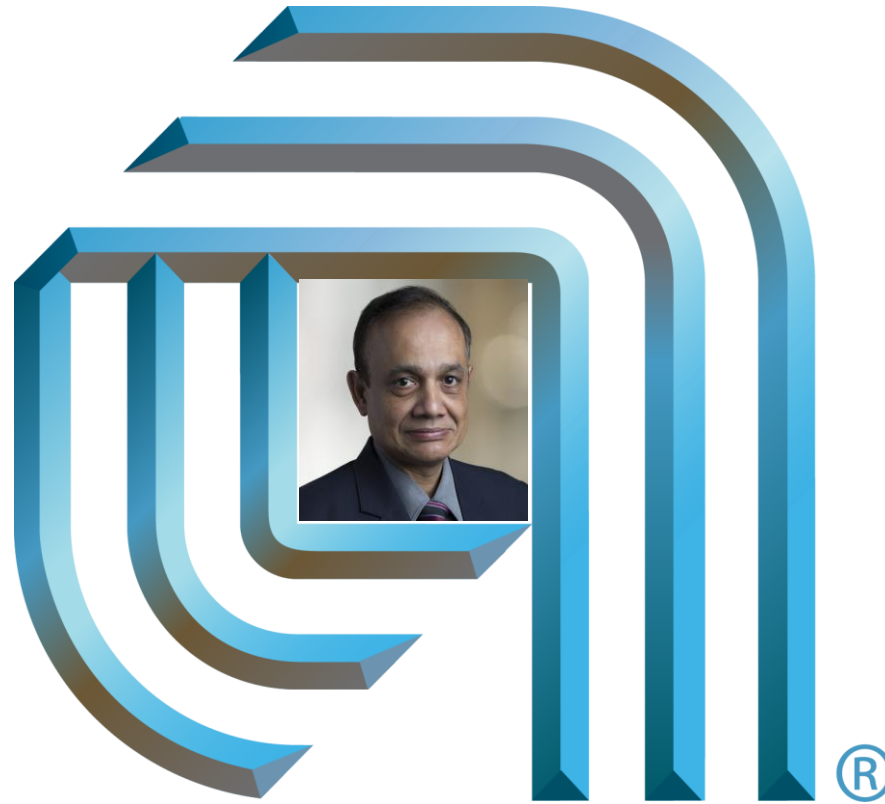
Uniquely positioned to capture  
growth from inflections

# Key Take Away for building Innovation Ecosystems for Semiconductors




- ✓ Build a Culture of Innovation
- ✓ With Customer at the Core
- ✓ Build Capacity
- ✓ Capture Opportunities Creatively
- ✓ Collaborate





Ashwini-K Aggarwal, PhD, FIETE

 *Accomplished* Government Affairs/Marketing  
Professional | Director-GA, Applied Materials/ Pas...



xlAshwini



xITVinspires



# Hyperconnectivity





# Hypercompetition





# **“The old industrial platform is collapsing”**

MARTY NEUMEIER



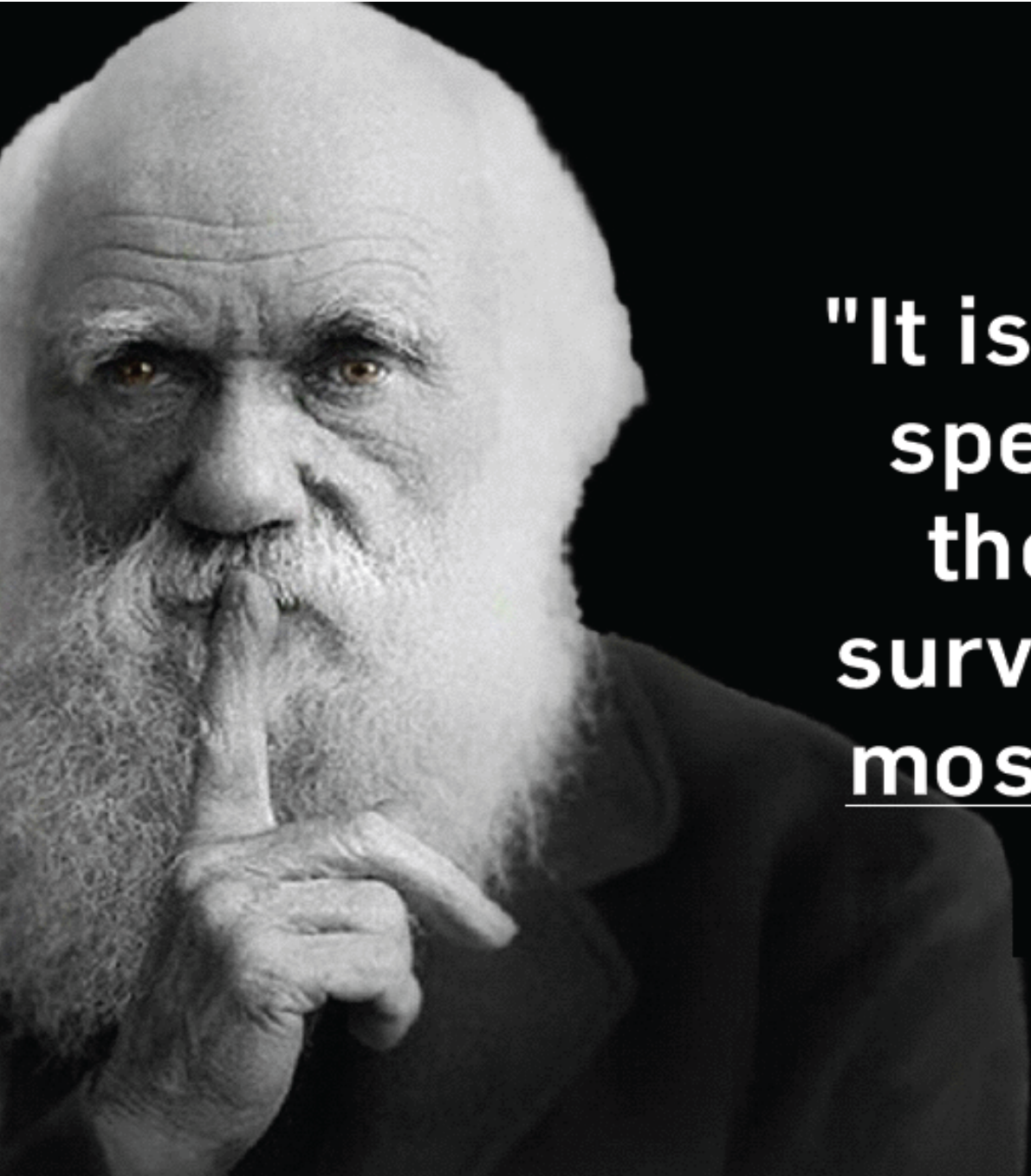
A school of sharks swimming in deep blue water, with the text "NO BUSINESS IS SAFE FROM DISRUPTION" overlaid in white.

# **NO BUSINESS IS SAFE FROM DISRUPTION**



**WE MUST LEARN HOW TO LIVE WITH  
UNPREDICTABILITY AND UNCERTAINTY.**





**"It is not the strongest of the species that survives; nor the most intelligent that survives. It is the one that is most adaptable to change."**

**CHARLES DARWIN**



# **Strategy or Culture?**





**CULTURE EITHER DRIVES OR  
DRAINES PEOPLE'S ENERGY  
AND MOTIVATION.**



**“CULTURE ISN'T JUST ONE ASPECT OF  
THE GAME, IT IS THE GAME”**

**Lou Gerstner - former turnaround CEO at IBM**