

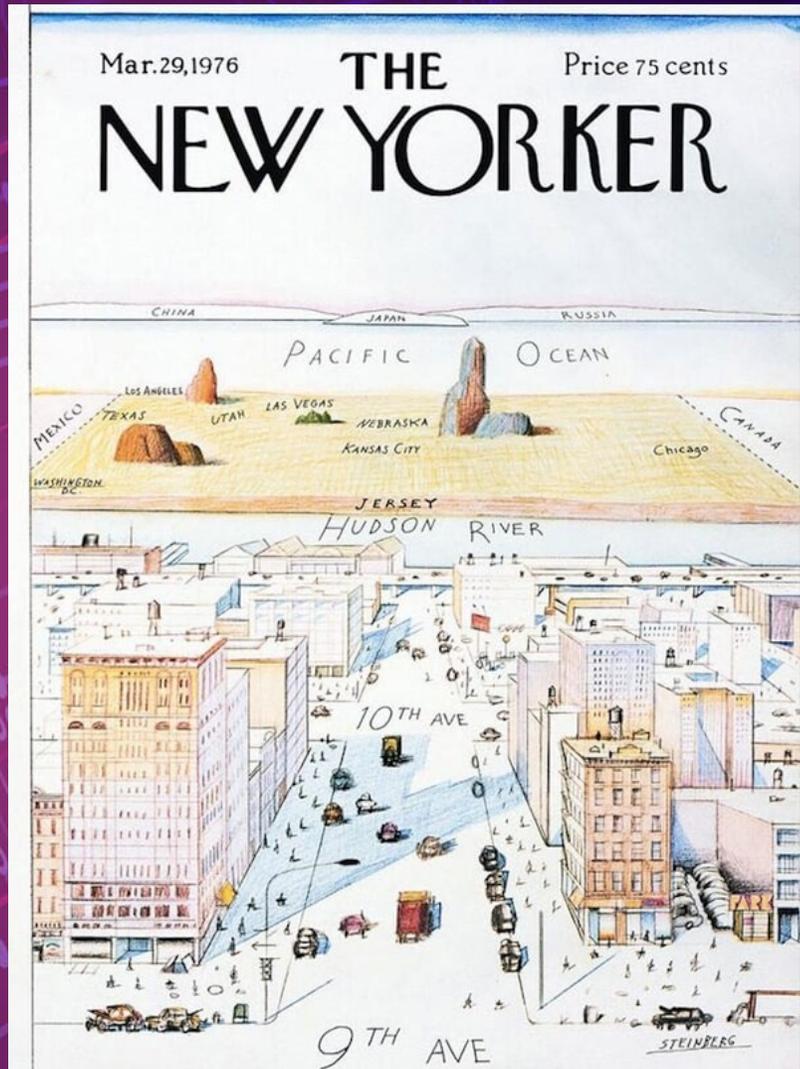
NGMM Phase 0 Review

Carl E. McCants

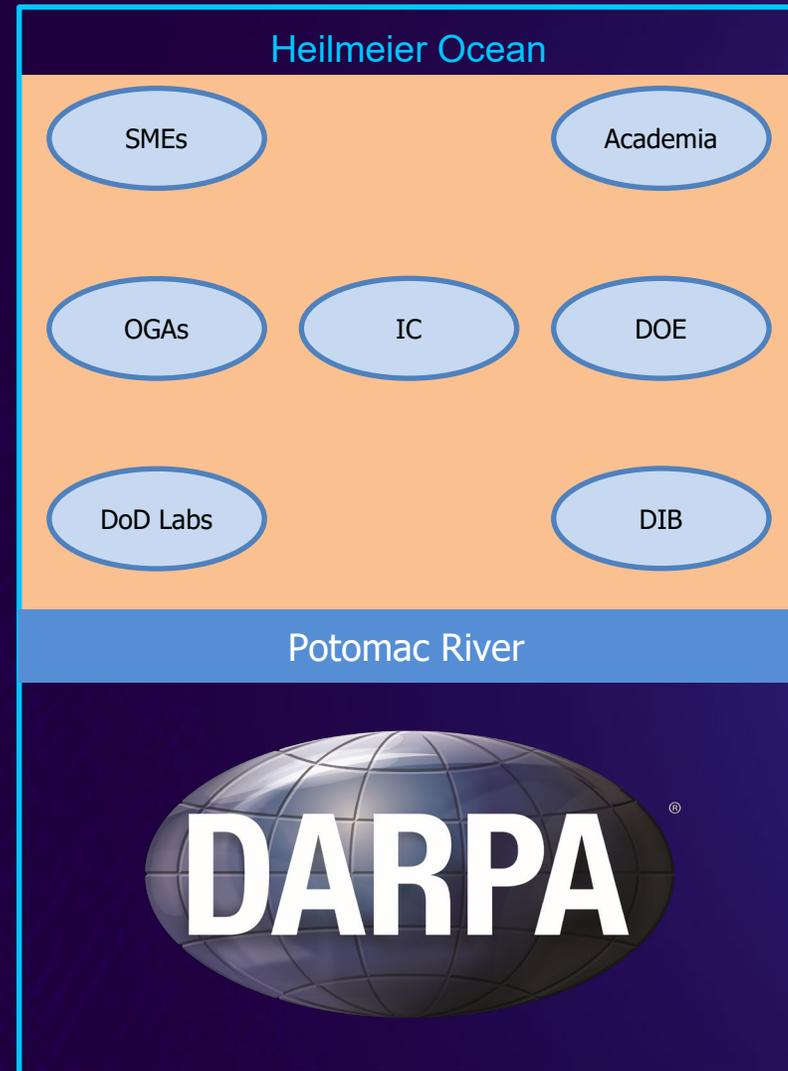
Special Assistant to the DARPA Director, ERI

NGMM: Next Generation Microelectronics Manufacturing

The importance of perspective – how we view the world...

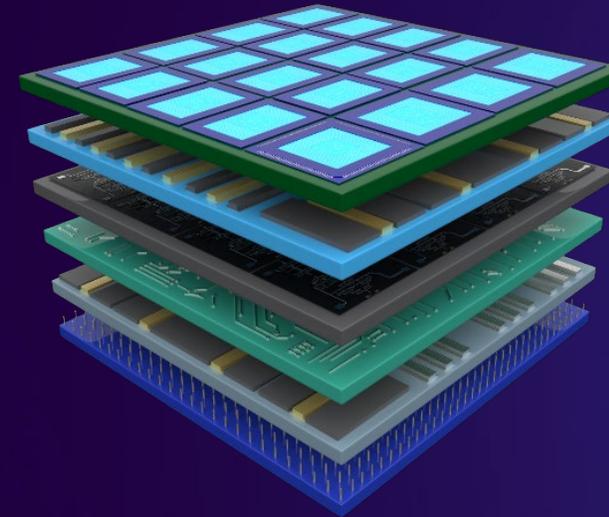
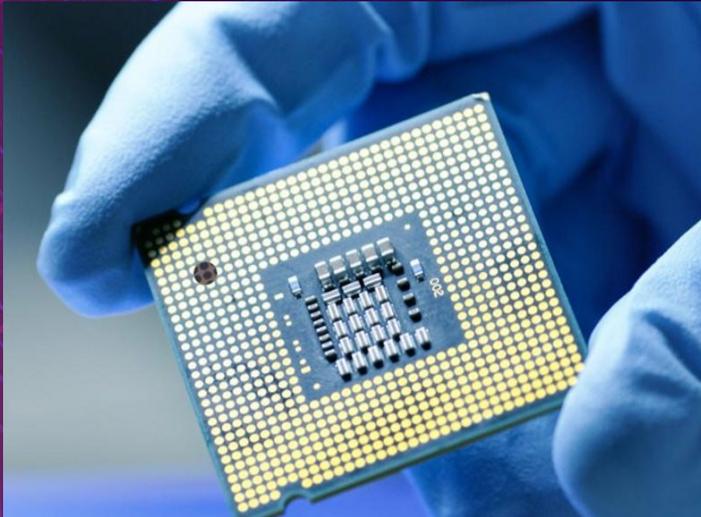


Source: <https://brilliantmaps.com/new-yorkers-world/>



Source: Author's Own

Microelectronics manufacturing inflection



Today	Future
2D, 2.5D	3D, 3.5D with dense interconnects
Monolithic integration	Disaggregation
Silicon	Multi-process / multi-material
Packaged after fabrication	Packaging no longer distinct

NGMM: creating a national capability for 3DHI R&D and pilot-line manufacturing

Users



Industry



Academia



Government

Source: Creative Commons



National capability



Source: Adobe Stock



Source: SUSS

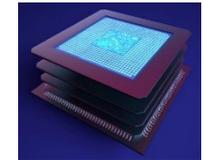
Manufacturing process



3DHI assembly design kit (3D-ADK)



Output



3DHI microsystem prototypes



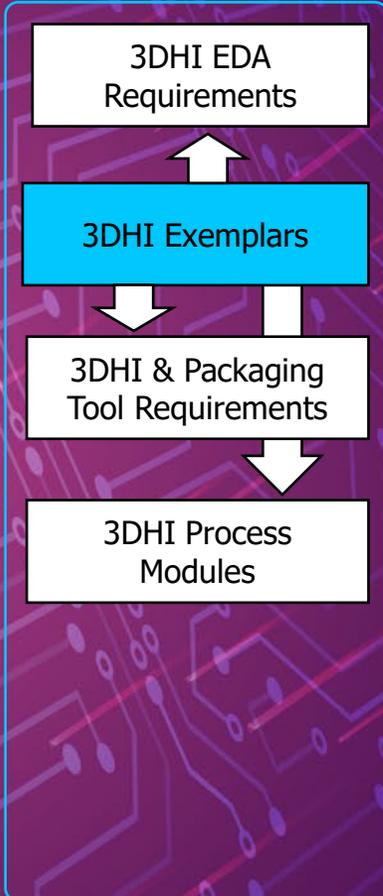
Source: Adobe

Digital twin

3DHI: Three-dimensional heterogeneous integration

NGMM Phase 0

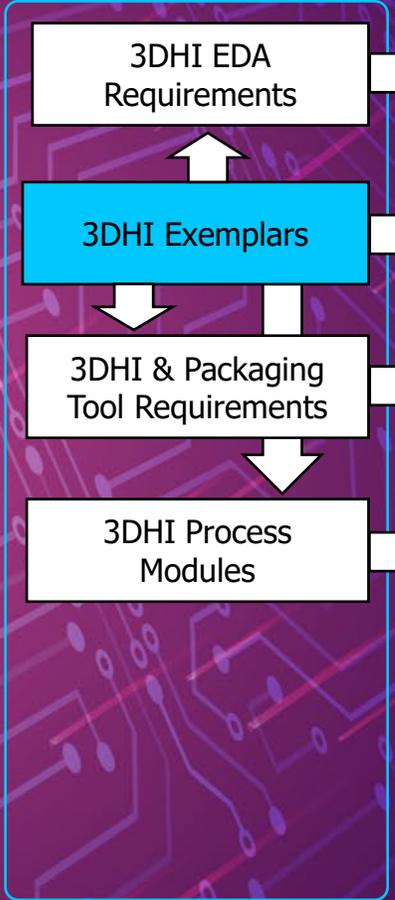
Phase 0 Define Baseline Capability



- **Inform planning for the 3DHI manufacturing center**
 - Define exemplar 3DHI microsystems
 - Identify equipment, processes, software tools, and facility requirements
- **Provide detailed analytical report**
 - Layout, performance benefits, and applications of exemplar 3DHI microsystems
 - Required equipment and process modules for manufacturing and test
 - Recommendations for IP model
- **11 teams selected for Phase 0 analyses**
 - 7 large businesses
 - 2 educational institutions
 - 1 small business
 - 1 non-profit
- **Teams are currently defining and documenting performance and process requirements for exemplars**

NGMM program structure

Phase 0 Define Baseline Capability



Phase 1 Establish Center



Phase 2 Qualify / Operationalize Center



**NGMM
Prototype
Transition to
Manufacturing**

**National
Open-Access
3DHI
Microsystem
Prototyping &
Pilot-Line
Manufacturing
Capability**

NGMM Phase 0 Performers (1 of 2)

Team	Exemplar(s)
Applied Materials	RF phased array, system on chip
Arizona State University	RF massive MIMO microsystems
HRL Laboratories, LLC	mmW phased array, focal plane array
ICAMR, Inc. (BRIDG)	V-band phased array
Intel Federal LLC	Slice of vertically stacked cube (e.g. AESA)
North Carolina State University	Power microsystem

MIMO: Multiple Input, Multiple Output

mmW: millimeter wave

AESA: Active Electronically Scanned Array

NGMM Phase 0 Performers (2 of 2)

Team	Exemplar(s)
Northrop Grumman Mission Systems	Infrared focal plane array
Northrop Grumman Space Systems	mmW MFA, Hyper-spectral imager, 670 GHz Radar Imager, G-Band MFA, 5KW scalable coherent DE Laser, Multi-function high-Q magnetic filter, photonic signal processing, 100GB Lasercom
PseudolithIC Inc.	mmW phased array
Raytheon Technologies	mmW phased array, focal plane array, photonics and laser array
Teledyne Scientific Company	Point-of-load voltage converter

mmW: millimeter wave

MFA: Multi-function array

DE: directed energy

For more details...

NGMM workshop on 24 August, 8:30 am to 1:45 pm

- **10-minute Lightning talks from each Phase 0 performer team**
- **Information on planned Phase 1 / Phase 2 solicitation**
- **In-depth question and answer section**

THANK YOU

