

SUMMARY:

- UAZ - Proposed Tenets for PIC Foundry IMI
 - o IMI should be about advancing the state of the art in manufacturing
 - o IMI should enable diverse applications
 - o IMI should help to drive maturation and stratification of ecosystem as in electronics, accelerate past today's independent, replicated, vertically- integrated approaches
 - o Excerpts from 3/14 White paper to OSD on PIC Foundry IMI Concepts (Slide 2)
 - o Quite a few RFI responses submitted in area of PIC technology
- At least 3 semiconductor manufacturers stated they were submitting independent responses
 - o One of the four co-authors for "consortium RFI response" Together with other academic and private-sector executive authors



Proposed Tenets for PIC Foundry IMI

Personal Perspective



- IMI should be about ***advancing the state of the art*** in manufacturing
 - Should not ***just*** be about broader access to technology which is in many cases already available to DoD & some industry partners, or already available in international community.
 - Can ***include*** access, but access to powerful new dimensions for both DoD and US industry partners.
- IMI should enable diverse applications
 - DoD: Signal processing, sensing, imaging, electronic warfare, datacom.
 - Private Sector: Datacom, biomed, sensing, entertainment.
 - Photonics fabricated directly in CMOS electronics layer may be critical for some apps, but for some applications too limiting ...
 - Platform must embrace other functional photonic & electronic materials (III-V, nonlinear, etc.).
 - Must provide intimate, low-parasitic assembly of diverse photonics with diverse VLSI electronics (photonic signal generation, detection, processing, imaging, sensing with logic, memory, I/O, PHY layer processing).
- IMI should help to drive maturation and stratification of ecosystem as in electronics, accelerate past today's independent, replicated, vertically -integrated approaches
 - Commercial fabs must be tightly integrated into effort for truly stable platforms, TRL 4-7
 - Develop integrated solutions using front-end for chip fab, back-end foundries for assembly & test, weave it together towards a sustainable, broadly applicable ecosystem
 - Maturation of CAD tools to address complete subsystem design suite, not just chip
 - Allow development in satellite foundries for custom applications with reduced cost, leverage PDK's for non-customized elements (such as back-end assembly & test) for dramatic reduction in development investment (time & \$\$).



Excerpts from 3/14 White Paper to OSD on PIC Foundry IMI Concept



- Optical connectivity within a board or assembly to other chipsets using either an extended optical interposer or an additional optical waveguide fabric that couples into the photonic interposer. This eliminates the need for unnecessary optical interfaces, and even optical fibers in some applications.
- Ultra-high optical I/O from processor chips, data engines, and memory chips, directly addressing bandwidth bottlenecks in supercomputer and data center applications.
- The use of TSV or low-capacitance TOV technology to locally drive optical sources or receive optical signals to/from the interposers into stacked specialized I/O and PHY CMOS chips or directly to processor or ASIC chips. This can provide performance gains even for simpler transceiver-like applications.
- The ability to heterogeneously integrate functional materials such as GaAs, InP, or nonlinear optical materials as may be required for targeted DOD signal processing or electronic warfare applications.

2.5D & 3D Photonically-Enabled Stacked-Chip Packaging

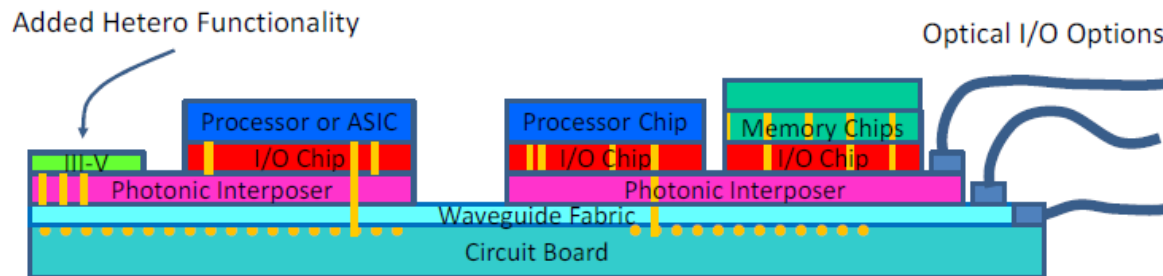


Figure 1. Example of silicon photonic interposers enabling high-functionality, high-bandwidth connectivity between electronic and optical functions.



On PIC Foundry RFI Responses ...



- Quite a few RFI responses submitted in area of PIC technology
 - At least 3 semiconductor manufacturers stated that they were submitting independent responses
 - Some of these also cooperated in “consortium RFI response”
 - All indicate that they want academic/private-sector consortia model.
 - One of four co-authors for “consortium RFI response” together with other academic and private-sector executive authors
 - This “consortium RFI response” included participation from:
 - 9 companies, include major US semiconductor, optical technology, networking, and defense contractor companies
 - 12 universities
 - 2 non-profits
 - Planned future participation of at least 2 FFRDC’s (could not be part of initial RFI/RFP process)