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The status of Cross Roads' core Liquid Chemical Deposition (LCD) technology is TRL/MRL 4 (i.e., laboratory demonstrated). We are poised to qualify the technology for broader commercialization (TRL/MRL 5) via a \$15 million program at Arizona State University's Core Research Facilities, with which we have a Letter of Engagement. The key metrics and design features sought to be achieved are set forth below.

Unique Material Differentiators

- Multi-element Materials (Ultra-High Performance)
- Atomic Scale Uniformity (Extreme Compositional Control)
- Deposition Rates Up to $25 \mu\text{m}\cdot\text{min}^{-1}$ vs. $1 \text{ nm}\cdot\text{hr}^{-1}$
- Big Nano-Phase - enables mass production of chips with exotic behaviors

Enhanced Microelectronic Architecture

- Displaces PCB+Chips+Discrete Passives
- Introduces fully integrated systems (Systems made as one part)
- Collapses discrete passive assembly and PCB-centric design into wafer-scale integrated passives plus stacked dies
- Cuts system assembly cycle times from ~16 weeks to a few days
- Drastically reduces manufacturing footprint, cost and time-to-market times. Offers a New

Standard – which may someday be recognized as “essential” in certain respects

- Actively cooled 3D Chip Stack
- Embeds ultra-high performance materials within stacked chip assembly
- Big Nano Thermoelectrics -- Cool high-density hotspots and recover a portion of waste heat as electricity
 - Target: thermoelectric layers capable of $\approx 300 \text{ W}\cdot\text{cm}^{-2}$ heat pumping with $ZT \approx 2$, enabling hotspot extraction and partial recovery of waste heat as electrical power (pre-validation modeling target).
 - Eliminates Water Cooling (30% of operational costs)
- Magnetic Registers snap Stacked Chips into alignment with photolithographic precision
- Mechanical constraints hold high conductivity/expansion members in place to prevent warpage
- Miniaturized Capacitors - improves signal integrity with properties that remain stable with changing temperature, frequency, and time (aging)

Miniaturizes Footprint & Power Requirements

- Should shrink size of Data Center from a football field to a local bank branch
- Aims to cut electrical consumption up to 1,000-fold

Working with Ohio Congressman Turner's Office, representing the District for the Air Force Research Laboratory (AFRL), which oversees CHIPS Act appropriations, that Office submitted a budget request and policy proposal for the 2027 NDAA. Cross Roads' patents align with AFRL's newly proposed policies and objectives.

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