

PROBLEM STATEMENT
RWP-MIC-24-01

Requirement Title: Advanced Printed Circuit Boards and Electronic Substrates

Critical Sector: Microelectronics

Background: Printed circuit boards (PCBs) and advanced packaging substrates are vital components in the larger microelectronics ecosystem, serving as the backbone of complex interconnections between circuit elements and integrated circuits (ICs). The global market share of the onshore U.S. PCB industry has sharply declined since the turn of the century, and domestic capabilities significantly lag those of near-peer adversaries. As a result, the U.S. defense industrial base (DIB) faces severe backlogs in fulfilling microelectronics orders due to critical shortfalls in high-mix, low-volume domestic PCB manufacturing capacity and increased design complexity. Concurrently, there is minimal onshore access to advanced substrate manufacturing or design for next-generation U.S. defense systems. This call for enhanced white papers focuses on several key initiatives related to manufacturing, materials, and reliability studies for advanced PCBs and electronic substrates. Manufacturing Capability Expansion and Investment Prioritization (MCEIP) seeks solutions to one or more of the technical topic areas described below.

Desired Objective: The DoD's Advanced PCBs and Electronic Substrates initiative is to invest in prototype projects across key strategic areas to bolster high-mix, low-volume domestic capabilities. Proposed solutions must be at least a technology readiness level (TRL) 6 and/or a manufacturing readiness level (MRL) of 5. Enhanced White Papers should align within one or more of the following technical requirement areas:

- **MIC-24-001:** domestic complex printed circuit board (High Density Interconnect [HDI] and/or organic Integrated Circuit (IC) substrate) construction and production capability and capacity;
- **MIC-24-002:** domestic sourcing for enabling manufacturing materials;
- **MIC-24-003:** improved microvia reliability; and
- **MIC-24-004:** high-density interconnect reliability data.

These technical topic areas are explained in detail below:

- I. **Domestic complex printed circuit board construction and production capability and capacity (MIC-24-001):** Prototype the development of domestic sources for printed board and/or organic IC substrates that have approximately ≤ 75 μm microvias, ≤ 50 μm traces and spaces, and ≤ 50 μm dielectric thickness and expand domestic capability and capacity to produce such products. This can include investments in prototyping various semi-additive process capabilities and capacity, building on those delivered by traditional subtractive processes.
- II. **Domestic sourcing for enabling materials for manufacturing (MIC-24-002):** Prototype state-of-the-art capabilities to enable the development of advanced materials for DoD applications (e.g., copper foils for modified semi-additive applications, build-up film

equivalents, advanced laminates for organic IC substrates, and solder masks for organic IC Substrate applications).

- III. **Improved microvia reliability (MIC-24-003):** Prototype new models for improving microvia reliability across various manufacturing sources. Develop and validate design rules and process parameters that yield stable / reliable results on current and emerging HDI, ultra HDI (UHDI) and/or organic IC substrate technologies. This could involve a detailed design of experiments (DOE) involving printed board designers, manufacturers, process equipment, chemistry, and materials suppliers.
- IV. **HDI and/or Organic IC Substrate reliability data (MIC-24-004):** Develop and prototype standards and test methods which assess the reliability characteristics of design rules, materials, and processes for HDI, UHDI and/or organic IC Substrate features. Other prototyping and test efforts could include sponsored and comprehensive highly accelerated stress testing of HDI and UHDI structures to assess long term operational reliability in high stress environments. Test requirements should be incorporated into relevant industry and DoD requirements and documents.

Anticipated Funding: Multiple awards are anticipated with individual project agreement funding estimated between \$5M - \$50M over the next five years, subject to future Government availability of funding. Proposed solutions are subject to negotiation, if selected for award.

Anticipated Security Level: Unclassified, however Controlled Technical Information and/or Controlled Unclassified Information may be required.

Estimated Period of Performance: Up to five years

Anticipated Data Rights: Government Purpose Rights (as appropriate for any data developed using government funding).

Technical POC(s): To be provided based on the focus areas for any proposed solutions selected for award.