

Project: CENTER for Technology-transition and Rapid-prototyping Of Infrared Detectors (CENTROID): Electronic Warfare (EW)

Problem: The CENTROID project seeks to provide an EW solution for advanced integration of electro-optic and infrared (EO/IR) with microelectronics. Very large-format focal plane arrays (FPAs) are a valuable and necessary component to the growing sensor shield surrounding our warfighters with protection and situational awareness. The current state of the art uses single-chip stitched CMOS Digital Read Out Integrated Circuit (DROIC) to underpin these large FPAs. However, these DROICs become more difficult and expensive to produce as their size grows, mainly due to manufacturing yield loss. Consequently, a single yielded FPA may require more than 150 CMOS foundry wafers to produce. This yield loss drives the schedule, risk, and cost of large-format FPAs making it prohibitive to proliferate such solutions into a broader range of applications.

Solution: The CENTROID project will develop cost-effective advanced large-format 3D infrared focal plane arrays (IRFPAs) by integrating pre-screened high-yield DROIC chipllets with a seamless large infrared sensor array via a high-yield, high aspect-ratio interposer wafer. CENTROID will prototype a broad-band midwave-infrared (MWIR) detector with a nominal 4k x 4k resolution and a 10 μ m pixel pitch. The CENTROID team is a close collaboration of performers spanning design, fabrication, and academic research that work together to address current and future technical challenges for manufacturing high-resolution large-format FPAs. The general approach will be done by separating the complex DROIC circuitry into high-yielding and low-cost chipllets which will be yield-tested prior to integration. These Known Good Die (KGD) DROIC chipllets will then be reconstituted into a wafer that will enable wafer-scale hybridization. Critical processes needed for successful wafer-scale processing including through silicon vias (TSVs) in the interposer wafer will be refined to support scale fabrication. The CENTROID solution has wide applications providing more capable large format (more resolution) arrays and enhancing DoW capabilities while reducing sensor SWaP-C (Size, Weight, Power, and Cost).

Project Performers / Role:

- **MMEC:** Project prime / program manager.
- **Attollo Engineering:** Detector wafer processing, 3D heterogeneous integration & testing of FPAs.
- **Senseseeker Engineering:** DROIC & Interposer design and development, FPA / DROIC characterization and test.
- **The Ohio State University:** Epitaxial growth and material characterization, and workforce development.
- **SK Infrared:** Detector design / MBE oversight, process evaluation, chip / FPA testing.



ADVANCING TRL / MRL : TRANSITIONING TECHNOLOGY INTO THE HANDS OF THE WARFIGHTER