Purpose: GOMACTech seeks contributions from government, academia, and industry in a broad set of critical technology areas in microelectronics and semiconductors supporting Government applications. We encourage authors to review the technical topic area descriptions and submit their abstract to the area that most closely aligns with their abstract.

TECHNICAL TOPIC AREAS

Advanced Materials and Processing	Photonic Technologies, Components, and Systems
Emerging Technologies	Power Electronics and Emerging Power Technologies
AI and ML in Microelectronics	Radiation Hardened Technologies, Designs, and Systems
High Performance Digital and Mixed-signal Technologies	RF Technologies, Components, and Systems
Packaging, Integration, Thermal, and Control Technologies	Trusted, Assured, and Cyber-secure Microelectronics

Advanced Materials and Processing

Advanced materials and processing approaches provide the catalyst for enhancing existing technologies, enable the use of current technologies in new ways and are central to pioneering new technological areas. In particular, government systems seek advanced materials that lead to breakthroughs in the RF/millimeter/THz regimes. Likewise, beyond-silicon materials for radiation- hardened electronics, and power electronics are sought after. These may include germanium, III-V, gallium nitride, diamond, aluminum nitride, oxide semiconductors, along with materials for extreme electrostatic control including carbon nanotubes, graphene, black phosphorous, and transition metal dichalcogenides. Understanding novel materials-driven phenomena like phase-changes, spin transport/lifetime, etc., are also of interest for future government systems. Finally, novel processing approaches have recently enabled the integration of dissimilar materials/devices onto a single substrate forming hybrid systems. This compilation of materials and devices gives rise to novel systems with enhanced performance that may also be flexible, soft, and potentially transient, thereby broadening their range of government system applicability.

This Technical Topic Area seeks contributed papers pertaining to this wide range of advanced materials and processes technologies and are expected to be more fundamental investigations.

(Kind reminder: Advanced and novel devices and components that apply the materials and processes are to be submitted to the Emerging Technologies topic area).

Emerging Technologies

Papers are sought detailing application of emerging technologies for government microsystem applications. Emerging technologies are a critical enabler for new information, signal and data processing capabilities of the future. The scope of technologies sought includes, but is not limited to, new concepts, devices, and components for integrated photonics, quantum information science and technology, quantum sensing S&T, quantum communications, neuroelectronics to include neuromorphic concepts, devices, and circuits, and bioelectronics sensors to include flexible electronics. It also includes new concepts and devices for integrated circuits beyond Moore's Law for example to include novel 3D technologies and heterogeneous integration of novel devices, hetero- epitaxial devices, carbon based electronic devices, and spintronic technologies (spintorque, spin-wave, etc.).

This Technical Topic Area seeks contributed papers pertaining to this wide range of novel device technologies to meet future national defense and security requirements.

(Kind reminder: Advanced material development, processes, and new manufacturing approaches for the devices and circuits are to be submitted to Advanced Materials and Processing topic area).

AI and ML in Microelectronics

The GOMACTech Conference invites submissions for a new technical track focusing on Artificial Intelligence (AI) and Machine Learning (ML) in Semiconductors and Microelectronics. This track supports cross-agency and Executive Branch priorities and is designed to showcase advancements that bolster national defense, secure supply chains, enable energy innovation, and enhance U.S. semiconductor competitiveness. Topic areas of interest include the Application of AI technology, Technology direction and system requirements, and AI/ML focused Hardware and Software.

Note: To avoid confusion, it is pointed out that abstracts submitted to this technical track should be AI/ML focused. Submissions to other technical tracks may still use AI/ML to address their objectives and remain under those TTAs (without any confusion) unless the focus of that work is on the AI/ML portion of the effort in which case their submission should be targeted toward this TTA.

High Performance Digital and Mixed-signal Technologies

This area spans digital microelectronics and mixed/signal integrated microsystems, especially those not covered elsewhere (e.g., radio frequency technology or packaging and integration topic areas). Papers are sought that detail current advances in the design and development of digital and integrated mixed-signal integrated chip solutions to meet the ever-increasing needs of DoD and dual-use applications such as artificial intelligence, communications, and computing with high performance, low power requirements. Novel digital circuits and circuit design techniques, components including application specific integrated circuits, custom integrated circuits, (embedded) field programmable gate arrays, systems-on-chip, systems-in-package, microprocessors and microcontrollers, and technologies that facilitate advanced digital design are of interest. With regards to mixed-signal, major advancements in one or more of a set of critical parameters like functionality, speed, bandwidth, frequency, power, dynamic ranges, etc. in highly miniaturized chip-scale substrates are of interest. Advances in design techniques and methodologies, devices, circuits, or entire chips including upstream and downstream-related technology areas (like design and test) are typical submissions.

Packaging, Integration, Thermal, and Control Technologies

Papers are sought detailing research and development related to post-chip fabrication technological work on integration, advanced packaging, and thermal management. "Integration" work refers to technologies that can be used to combine different types of chips together in seamless and new ways (2-2.5D, 3D integration, and interposers are examples, but others are encouraged). Packaging refers to the broader technology area of assembling chips into completed assemblies and encompasses materials, processes, and interconnections (electrical and possibly others). Work in "thermal and control technologies" refers to efforts in advancing new types of cooling and thermal solutions for a diverse array of chips needed for defense applications (including but not limited to gallium nitride amplifiers and high-performance 3D computer chips).

Photonic Technologies, Components, and Systems

In this technical topic area papers are sought for Photonic Technologies, defined as the application of opto-electronics to enhance or replace electronics for critical government applications. Photonic technologies span Radio Frequency (RF), analog, and digital domains. Here RF photonics is attractive for signal

transmission and processing in sensors systems due to benefits of lightweight, low-loss, wide-bandwidth, and high-frequency operation over conventional electronics. Particular areas of interest include RF Photonic signal processing (e.g. RF up/down conversion), simultaneous transmit and receive (STAR) systems, antenna remoting, phased-array beamforming, sensors, and other applications/work using both bulk and, of particular interest, highly integrated approaches. Digital photonics is already prolific in digital networks, nevertheless, advances in robust and rugged optical interconnects and integration with electronics for Government applications is also of interest.

Power Electronics and Emerging Power Technologies

Papers are sought covering all aspects of power electronics research and development from materials development and basic devices to circuits and systems. Submissions are encouraged in the areas of wide- and ultrawide-bandgap material development and device results (gallium nitride, gallium oxide, silicon carbide, aluminum nitride, and diamond), pulsed power, wireless power transfer, and novel power distribution architectures.

Radiation Hardened Technologies, Designs, and Systems

Papers are sought detailing research and development work related to advancing the state-of-the-art in radiation hardened microelectronics in the following areas:

- Radiation hardened (rad-hard) technologies and systems featuring research on current rad-hard technology programs, including captive integrated circuit processing, rad-hard fabrication through trusted commercial foundries and manufacturing innovation. Also of interest are rad- hard systems under development for DoD and dual-use applications and radiation test guidelines for critical applications.
- Rad-hard characterization methods and mechanisms featuring research on novel radiation hard characterization methods, basic mechanisms of radiation effects in novel nano-devices, and research on developing atomic-scale understanding of radiation effects and in atomic-scale defects. Methods of interest include but are not limited to electrically detected magnetic resonance and laser induced quantification of single event effects.
- Radiation hardened by design (RHBD) electronics research, from an applied, design perspective. Research areas of interest include design tools for sub-100nm technologies, radiation mechanisms and mitigation in high-speed analog and mixed- signal circuitry, and scalable RHBD techniques.
- Rad-hard and space applications including all aspects of computing in the space radiation environment from high reliability critical control applications to high through put data processing. Subjects can include all aspects of space processing from traditional radiation hard by process and design through software fault tolerance and real number parity calculations.

RF Technologies, Components, and Systems

Papers are sought in the broad field of radio frequency technologies from low frequency to *mm*-wavelengths and beyond, with particular emphasis on microsystem design and demonstrations of:

- Reconfigurable electronics, self-healing circuits
- Phased Arrays, beamforming, on-chip antenna integration
- High-efficiency and broadband high-frequency power amplifiers, with emphasis on thermal design and management
- Heterogeneous integration of process technologies implementing complex on-chip functionalities
- Systems-on-chip, mixed signal circuits, high speed data interface and transport between chips.

Contributions in areas tackling new challenges and/or demonstrating new capabilities in the RF technology field are also welcomed.

Trusted, Assured, and Cyber-secure Microelectronics

Papers are sought in broad areas including novel techniques for measuring and verifying trust, assurance and cyber security and defining, creating, establishing thresholds and confidence in trust or assurance of microelectronics products. Areas of interest include verification and validation techniques for detecting tampering, exploitation and counterfeiting in microelectronics products, novel techniques for preventing and being resilient to malicious actions and counterfeiting in the microelectronics supply chain, embedded cyber security solutions and integrated software/hardware cyber-secure electronics. Programmable systems are also of particular interest, including vulnerabilities in programmable microelectronics as well as new approaches to monitoring and protecting programmable products and their features against exploitation. Finally novel techniques that can be applied to diagnose potential exploitations confirm actual counterfeits or tampering and develop evidence of the origin of anomalies and intent of adversaries and techniques that can be used to effectively screen for these exploitations.