

Attachment 1 – DAGSI Research Topic

NOTE: Under the Cooperative Agreement, Technical Directorates have three options for topics. First, a topic can strictly be considered in the pool for the state allocation of funding. DASI will work across the TDs for this allocation. Second, the TD can be prepared to be a funding partner with the State of Ohio. This would include: providing additional funds to support additional recipients of a topic, or expand the proposers team to include additional members on a topic. Third, the TD may elect to fully fund a topic not selected for State of Ohio funding or to pursue University teams outside the State of Ohio. Contact Michael.hitchcock.3@us.af.mil for questions

1. Research Title: Materials for Switching Memory Devices

2. Individual Sponsor:

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3. Academic Area/Field and Education Level

Electrical Engineering, Material Science, Physics, Mechanical Engineering
(BA/BS, MS or PhD level)

- 4. Objectives:** An overarching theme for this research is materials development to enable more precise control over the memristor switching properties, electrical testing results from device pairs that exhibit multi-terminal latching, and efforts towards integration of multiple devices to emulate neuron functions such as programmable spiking behavior. The ultimate goal of this research program is the realization of a memristor-based, fully non-digital, neuron equivalent that can function as a unit cell in a cellular neural network.
- 5. Description:** Dense crossbar arrays of non-volatile memory (NVM) devices represent one possible path for implementing massively-parallel and highly energy-efficient neuromorphic computing systems. Different types of NVM devices – including phase change memory, conductive-bridging RAM, filamentary and non-filamentary RRAM, and other NVMs for use within a neuromorphic computing application would be investigated in this research. Specific research would look into synthesis by Atomic Layer Deposition and Pulsed Laser Deposition, device processing (photolithography), and device performance characterization of these NVM materials. Material characterization methods like SEM and TEM (material microstructure and morphology), spectroscopic ellipsometry, x-ray diffraction, atomic force microscopy, photoluminescence, temperature-dependent Hall-effect/sheet-resistivity, temperature-dependent current-voltage, deep level transient spectroscopy, transmission line, TDTR (Time Domain Thermo Reflectance) can be applicable to establish structure property

relationships. Applicants with backgrounds in various semiconductors and their electrical and thermal characterization techniques, and in simple device processing techniques are desirable. The impact of this research effort will enable significant improvement in autonomous capabilities of Air Force weapons systems and improve the decision making process under the big data challenges.

6. Research Classification/Restrictions: NA

7. Eligible Research Institutions: University of Dayton, Wright State University, OSU, UC

NOTE: Topics submitted to DAGSI must be approved for public release. Need PA Approval #