

## FY25/26 DAGSI Research Topic

1. **Research Title:** Next generation resonant microelectromechanical systems (MEMS) for aerospace precision navigation and timing (PNT)
2. **Individual Sponsor:**  
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3. **Academic Area/Field and Education Level**  
Electrical Engineering (M.S. or Ph.D. level), Mechanical Engineering (M.S. or Ph.D. level), Physics, Applied Physics (M.S. or Ph.D. level)
4. **Objectives:** The primary objectives of this research are to conceive and develop novel prototypes of on-chip resonant microelectromechanical systems (MEMS) for position, navigation, and timing (PNT) applications that transcend state-of-the-art in performance, size, power, and environmental operating constraints.
5. **Description:** This topic is looking to advance the state of the art in fundamental design and operating techniques of MEMS resonator technologies to improve frequency stability for timing (MEMS based clocks) and reduce long duration position error for inertial sensing based position and navigation (MEMS based gyroscopes). Specific emphasis is on resilience in arduous environments (high temperatures, shock) while minimizing overall system size, weight, power, and cost (SWaP). Establishing computational modeling and simulation methods for predictive design in concert with robust experimental demonstration is central to this work. Exploration of both traditional and non-traditional materials systems, sensing and actuation modalities to include exploitation of nonlinear dynamics and optomechanical schemes, and advanced heterogeneous packaging solutions are all within scope.  
  
References:  
Watkins, C. A., *et al*, (2025) JMEMS, 34, 1, pp. 15-23, Feb. 2025, doi: 10.1109/JMEMS.2024.3515098  
Liu, Z. *et al*. (2024). *Communications Engineering* 3, 87 doi: 10.1038/s44172-024-00234-z  
Yu, J., & Cho, H. (2023) *Sensors and Actuators A: Physical*, 362, 114619 doi: 10.1016/j.sna.2023.114619
6. **Research Classification/Restrictions:** Unclassified/U.S. Citizenship required
7. **Eligible Research Institutions:** Universities (DAGSI), Air Force Institute of Technology

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