

## AFRL CALL FOR RESEARCH

1. **Research Title:** *Software Development for Mechanical Systems Health Monitoring*

2. **Individual Sponsor:**

Dr. Nelson H. Forster, AFRL/RQTM  
Bldg 490, Mechanical Systems Research Laboratory  
1790 Loop Rd N  
WPAFB, OH 45433-7333  
Nelson.Forster@wpafb.af.mil

3. **Academic Area/Field and Education Level:** Computer Engineering or Electrical Engineering (MS level)

4. **Objectives:** Develop software that combines data from existing oil debris monitor and high frequency accelerometers to provide fault isolation of failing component in turbine engine mechanical system.

5. **Description:** The MetalSCAN oil debris monitor sensor has proven effective in identifying metallic debris in the oil in the early stages of a bearing or gear failures but cannot determine the source of the debris without engine teardown. Vibration analysis can isolate the source of failure using analysis for characteristic component frequencies. However, vibration alone is not effective at providing early failure recognition in the high vibration environment of a gas turbine engine. The Mechanical Systems Research Laboratory has full-scale engine bearing test rigs and a T63 helicopter engine test stand to test rolling element bearings and gears with seeded faults. The objective of the topic is to write bench top demonstration software that will use the oil debris monitor indication as a trigger to query vibration data for source identification. The software will fuse the oil debris and vibration data to identify the source of the debris and track progress. Oil debris and vibration data can be recorded real time with a time stamp to post process the data for software development. Proof of concept will be performed with full-scale engine hardware in rig and engine tests at the Mechanical Systems Research Laboratory.

6. **Research Classification/Restrictions:** U.S. Citizens only. The development of the software and basic demonstration of the software can be published in the public domain. Some aspects such as engine test conditions and post processing of the data may be ITAR restricted.

7. **Interest in Summer USAFA Cadet:** No

8. **Eligible Research Institutions:** Place an X in all that apply.

Universities (DAGSI)       AFIT       USAFA