

Mechanical Systems Research Laboratory (MSRL)



Description:

This facility supports research and development for gas turbine engine mechanical systems. Research topics include basic mechanisms involved in the lubrication of bearing surfaces; basic mechanisms of bearing rolling contact fatigue, development and qualification of high-temperature synthetic lubricants and bearing materials; mechanical systems health management technology; computer modeling of mechanical system components; and alternative lubrication and bearing concepts for advanced turbine engines. The facility includes several experimental test rigs used to assess bearing performance for different size engines and applications. The High Mach Engine Bearing Test Facility simulates the conditions of large bearings for future man-rated high Mach engines and is used to validate bearing thermal models. The Bearing Life Assessment Facility measures fatigue life of new candidate bearing materials and lubricants for near-term development engines and investigates fundamental fatigue failure mechanisms of advanced bearing materials. The Oil-Free Test Facility measures the performance of air-foil bearings and magnetic bearings for more revolutionary engine concepts. Prognostic and diagnostic sensors are incorporated in many of these rigs to develop advanced engine mechanical systems health management technologies. Computer modeling is an integral part of MSRL's research effort and involves structural and thermal finite element analysis and rotor dynamic modeling of custom built test rig designs, bearing performance modeling, and experimental validation of these models. Additionally, there is an extensive analytical chemistry laboratory for engine lubricant development and qualification. Experimental test rigs to assess lubricant performance and chemical characteristics include; engine lubrication system simulator to study hot spot oil coking, tribometers, viscometers, foaming and thermal/oxidative exposure rigs that measure lubricant performance and rheological characteristics. Analytical instruments include a scanning electron microscope equipped with Energy Dispersive X-ray Spectrometry (EDS), metallurgical microscopes, gas chromatography, mass spectrometer, atomic emission, Fourier Transform infrared microscope, differential scanning calorimetry, and thermal gravimetric analysis.

Purpose:

Research and development of mechanical systems for aviation gas turbine engines. Provide field support to USAF and DoD units. Transition advanced mechanical systems hardware to U.S. aviation gas turbine industry.

Products:

- Rolling element bearing technology
- Synthetic lubricants for use in air breathing propulsion and power systems
- Hybrid (ceramic/metallic) bearings
- Carbon-carbon composite bearing cages
- Vapor phase lubrication technology
- Mechanical systems diagnostics/ prognostics sensors and life prediction algorithms
- Gas/foil bearing technology
- Bearing fatigue life testing and spall propagation mechanisms
- Modeling of mechanical systems performance, heat generation/transfer, and rotor dynamics

Availability:

Primarily in-house and related DoD contractor research. Other U.S. Government agency, DoD contractor and commercial customer programs upon request. Contact: 937-255-5568.