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**A Test Stand for Dynamic Characterization of Oil-Free Bearings
for Modern Gas Turbine Engines**

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ABSTRACT

A multi-purpose rotor-bearing dynamic simulator was designed and fabricated for the purpose of experimentally evaluating and validating performance of advanced oil-free and back-up bearings under realistic dynamic conditions. The rotor-bearing dynamic test rig is capable of operation to 25,000 RPM, has a 54 kg test rotor, is designed to simulate a medium size aero gas turbine engine rotor, and incorporates an electromagnetic loader/shaker capable of applying both static and dynamic loads to the rotating shaft. Testing was completed with the rotor fully supported by magnetic bearings, compliant foil bearings, hybrid foil/magnetic and Zero Clearance Auxiliary Bearings. These tests demonstrated numerous advances in oil-free bearing technology. The first ever achievements include: operation of a rotor with a mass in excess of 50 kg supported solely by foil bearings, operation of hybrid foil/magnetic bearings to high speed, continued operation following simulated magnetic bearing failures for a fully hybrid foil/magnetic bearing support system, and operation of a rotor supported solely by Zero Clearance Auxiliary Bearings. Data from several tests of the bearing systems are presented.