

WTC2005-63951

TURBOJET ENGINE DEMONSTRATION WITH A HIGH TEMPERATURE AIR FOIL BEARING

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ABSTRACT

Recent tests demonstrated successful operation of a turbojet engine with a compliant foil air bearing using a new high-temperature solid lubricant coating. The hot section rolling element bearing and corresponding lubrication system were replaced with a compliant foil air bearing using a composite solid lubricant coating capable of operating at temperatures well above 650°C (1200°F). Detailed engine integration studies, bearing component rig testing and hot engine simulator tests were completed prior to the successful engine test. The rig and simulator tests verified high temperature capabilities of the bearing and its surface coating, the bearing journal design, bearing dynamic performance, and rotor-bearing system dynamic stability, prior to engine integration and test. Based on these preliminary efforts, the engine and bearing were assembled and tests were conducted that included over 70 start stop cycles (including hot restarts), seven simulated mission cycles and more than 14 hours of run time. The foil bearing and engine operated flawlessly throughout the test. Vibrations were very low and all temperatures and pressures were as expected. The post-test inspection revealed that the bearing, journal and coating were all in excellent condition. Keywords: compliant foil bearing, high temperature coating, solid film lubricant, gas turbine engine, and turbojet engine.