

A Turbojet Engine Demonstration with Air Foil Bearing

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1. Mohawk Innovative Technology, Inc.

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ABSTRACT

A test of the WJ24-8 turbojet engine, the main propulsion engine for the BQM-74 target drone, was recently conducted that demonstrated successful operation of a turbojet engine with a compliant foil air bearing. For this effort, the hot section rolling element bearing and the entire existing lubrication system was replaced with a compliant foil air bearing. This technology demonstration test showed the ability of the foil bearing to operate in the extremely challenging environment behind the turbine. 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. A posttest tear down and hardware inspection revealed that the bearing, journal and all components remained in perfect condition. These data will be used to further the application of foil bearings to numerous other gas turbine engines for both military and commercial systems.

Key words: turbojet, oil-free gas turbine engine, unmanned air vehicle, uninhabited air vehicle, compliant foil bearing, air bearing, gas bearing.