

## TESTING OF A SMALL TURBOCHARGER/TURBOJET SIZED SIMULATOR ROTOR SUPPORTED ON FOIL BEARINGS

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### ABSTRACT

A small rotor designed to simulate a miniature turbojet engine or turbocharger rotor mounted on compliant foil bearings was tested at speeds in excess of 150,000 rpm and temperatures above 260C (500F). The simulator rotor-bearing system was operated while positioned in various orientations and was subjected to transient shock impacts exceeding 35-Gs. Subsequent testing was completed to demonstrate the capabilities of miniature thrust foil bearings as well. The tested rotor weighed approximately 400 grams, used 15 mm diameter foil journal bearings and a multi-pad 25 mm diameter double acting thrust foil bearing. Results of the rotor bearing system dynamics are presented along with experimentally measured natural frequencies, rotor displacements and thrust load carrying ability. Good correlation between measurement and analysis is observed. Very short rotor acceleration times from rest to maximum speed were also measured. A parallel test simulator has been used to accumulate over 1,000 start-stop cycles to demonstrate the life of the bearing and coating. Based on this successful testing it is expected that the goal of developing oil-free turbochargers and small turbojet engines that operate at high speeds with long life will be achieved.