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**THE APPLICATION OF FOIL SEALS TO A GAS
TURBINE ENGINE**

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Walled Lake, MI

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ABSTRACT

The feasibility of installing high speed and high temperature compliant foil bearings and seals in the hot section of a small gas turbine is investigated both numerically and experimentally. In order that an experimental investigation be conducted, a dynamic simulator representative of a small gas turbine engine spool was designed and fabricated, including components coated with a high temperature solid film lubricant. Foil seal design analysis, seal performance and system rotor-dynamics, including critical speeds, and stability used in the design of the engine dynamic simulator are discussed. The developed air turbine driven dynamic simulator is designed for speeds to 60,000 rpm, bearing/seal compartment temperatures to 550°C, a compliant foil bearing and a compliant foil seal in the simulated turbine section and an oil-mist lubricated ball bearing support in the simulated compressor section. These design parameters exceed the expected operating environment and thus will permit testing in excess of requirements. Preliminary test results with the dynamic simulator are presented showing that a hybrid rotor-bearing system employing foil bearings and rolling element bearings can be successfully operated

throughout a wide speed range. This successful test was made possible by the high level of internal damping achieved in the foil bearing. Preliminary seal performance will also be presented.