

**EVALUATION OF LARGE COMPLIANT FOIL SEALS UNDER ENGINE
SIMULATED CONDITIONS**

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ABSTRACT

The results of recent design and development efforts on a large compliant air lubricated foil seal (CFS) to meet the NASA test engine simulator is presented. The tested seal is 152 mm in diameter with an effective length of 15.24 mm. This work is built upon the successful operation of a smaller scale CFS (72.1 mm diameter) that was reported in previous works. In order to increase the capability of the seal to stand the higher differential pressure, the seal was also modified. The modified seal showed better leakage performance and include a structure which is more robust. During the normal operation, the surfaces of the rotor and seal are separated via a thin high-pressure air film.

A CFS features metallic bump foils that provide structural compliance. This feature allows for maintaining the non-contact operation in presence of thermal, centrifugal growth and excursion of the rotor. A dynamic seal test rig, representing a gas turbine engine simulator, was designed, built and tested for performance evaluation of a 6-inch diameter CFS. The test engine was supported by a grease-packed rolling element bearing and a

magnetic bearing. The magnetic bearing, in addition to serving as a support bearing, was employed to control the position of the rotor and to provide rotor operation under a desired eccentricity for CFS. The dynamic test engine is capable of operating at speed up to 20,000 rpm and temperature up to 1200 °F. The CFS performance at various operating speeds and differential pressures was investigated.
