



WJ24-8 Turbojet Engine Demonstration Testing with Air Foil Bearing!

Williams International, LLC and Mohawk Innovative Technology, Inc. (MiTi[®]), working together under a jointly funded development effort, recently conducted the first successful hot fire test of a turbojet engine with a MiTi[®] air foil bearing. The WJ24-8 turbojet engine, which is the main propulsion engine for the US Navy BQM-74 series of target drones, was selected for this technology readiness evaluation test series to assess performance and reliability benefits of using aerodynamic foil bearings in gas turbine engines. This technology demonstration test also showed the ability of the foil bearing to operate in the extremely challenging environment directly behind the hot turbine rotor.

Engine and Bearing Integration

During this effort, Williams International and MiTi[®] replaced the hot section rolling element bearing with a MiTi[®] foil bearing, eliminated the entire existing lubrication system and completed the necessary engine-bearing integration designs. In parallel, MiTi[®] designed the bearing, established bearing operating requirements and conducted extensive rig and simulator testing. These 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.

Engine Testing

Based on these joint preliminary efforts, the engine and bearing were assembled and tests were conducted at Williams International facilities in mid December 2002. Over 30 start stop cycles (including hot restarts) and more than 1 hour of run time were accumulated in this first test. Maximum design operating speed and gas temperatures were attained during testing, making this, the first ever demonstration test of its kind.

Preliminary Data Analysis

The foil bearing and engine operated flawlessly throughout the test. Vibrations were very low and all temperatures and pressures were as predicted. A post test tear down and hardware inspection revealed that the bearing, journal and all components remained in perfect condition.

Road Paved for Further Developments

Based on this very successful demonstration of the integrated WJ24-8 and the MiTi[®] aerodynamic foil bearing, additional testing and developments are planned to further refine and quantify the benefits to be gained with foil bearings. These data will then be used to assess the application of foil bearings to numerous other gas turbine engines for both military and commercial systems.



Fig. 1. WJ24-8 rotor, aft housing and MiTi[®] air foil bearing after engine demonstration test.

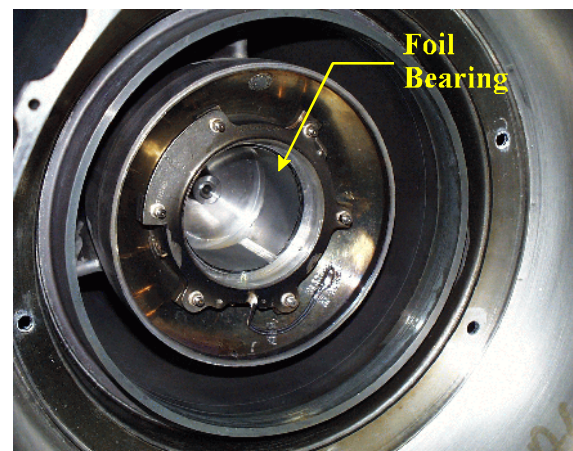
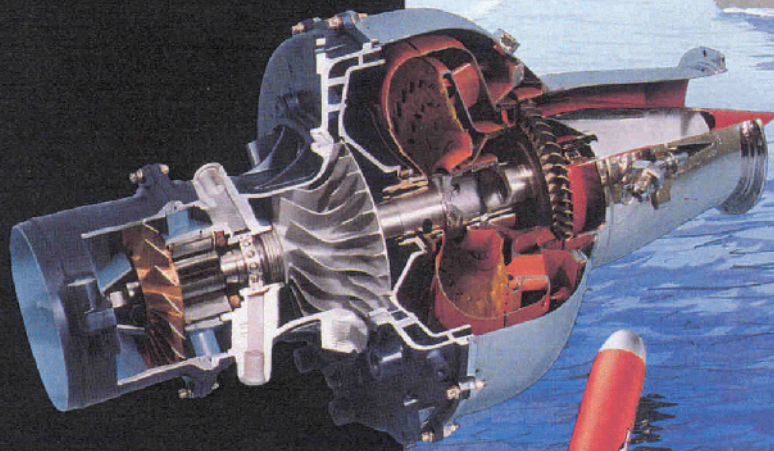


Fig. 2. Post test closeup view of MiTi[®] air foil bearing installed in WJ24-8 tail cone.

WJ24-8 Turbojet Engine

The Williams International WJ24-8 turbojet engine is the main propulsion for the U.S. Navy BQM-74C/Chukar III and BQM-74E target drones.



The BQM-74 series of target drones are used by naval battle groups for realistic target and missile simulation during weapon system test and training operations.



Williams International

MiTⁱ® Foil Bearings make oil-free engines possible

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Hooshang and LaVern Posing with the WJ24-8 After Completion of Successful Demonstration, December 2002