

## Evaluation of blade tip sensors for spin testing with oil-jet excitation

Ross Antoniou, Neil Martin, Jianfu Hou and Wenyi Wang

*Abstract:* DST Group is commissioning a medium scale spin testing facility with oil jets for resonant high cycle fatigue (RHCF) excitation. The facility will be used for RHCF analysis and characterisation, blade damage detection and health monitoring of integrally bladed rotors (IBRs or blisks); it will also be used for certification testing of IBRs returning into service after repair, e.g. blending or laser cladding. Blade tip sensing technology has emerged as one of the primary technologies for turbine engine blade health monitoring, and eddy current tip sensors are integrated into the JSF F135 engines. A TTCP (the technical cooperation program) study assignment is proposed to support the DST Group test rig commissioning by identifying and evaluating the status of appropriate blade tip sensors (e.g. eddy current, microwave, optical and capacitance tip sensors) in an oil mist testing environment. The objective of this study is to provide all TTCP nations (Australia, Canada, New Zealand, United Kingdom and United States) a better understanding of the available technologies that could be used in test cell instrumentation and on-wing, and potential access to two separate facilities (with the other one at US Navy Air Warfare Center) for on-going activities into health and usage technologies, FOD damage and repair regimes going forward. In this presentation, we will report the preliminary findings of the evaluation and the planning of future tests using the down selected tip sensors in the RHCF spin testing rig at DST Group. We will invite a range of sensor providers following a down select to participate in a trial managed by the TTCP AER Panel. Key down selection criteria of vendors will be based on mature sensor systems (TRL Level 5 or higher) with real time data capture, analysis, visualisation, playback and zoom capabilities (e.g. waterfall plots, FFT, blade time of arrival plots etc.) with evidence demonstrating capability in the presence of an oil mist.

*Keywords:* blade tip sensor, resonant high cycle fatigue, spin testing, oil-jet excitation.