THE TRIBOLOGICAL PERFORMANCE OF GAS TURBINE LUBRICANTS

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ABSTRACT
The purpose of this project is to evaluate the performance of a number of novel and commercial oil candidates over the range of conditions seen within the oil system of Rolls-Royce gas turbines. This project will focus primarily on Rolls-Royce's future concept gas turbine, the UltraFan™ (Figure 1), which poses a new tribological challenge for the lubricant.

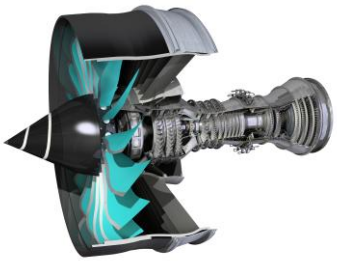

Figure 1 - Rolls-Royce's new future concept engine the UltraFan™.

It features a Power GearBox (PGB) between the intermediate pressure turbine (IPT) system and the corresponding fan that it is driving, the first of its kind in the large civil engine market. The PGB allows the fan blades to rotate slower than the IPT resulting in a large efficiency benefit. Therefore the lubrication system needs to be able to support the new PGB environment as well its other components such as ball and roller bearings, accessory gear boxes and splines etc.
Aviation lubricants are comprised of a base stock oil (~95% of the formulation and is generally a long chain ester) as well as a variety of different additives in order to enhance performance. Such additives may include anti-oxidants, anti-wear, corrosion inhibitors, and anti-foam additives [1]. Although the thermal properties of lubricants have been extensively investigated, there is a lack of understanding about their tribological performance under the high loads present in the PGB [2].

This research utilizes two tribology rigs to assess a range of lubricants under representative engine conditions. A Mini-Traction Machine (MTM) is being used to monitor traction coefficient (friction) of different lubricants over a range of speeds and therefore lubrication regimes.

The Spacer Layer IMaging (SLIM) is an extension to the MTM that uses optical interferometry to measure the thickness of boundary films. Lubricants with different amounts and amounts of boundary additives are being compared.

A MicroPitting Rig (MPR) is also being used to evaluate different lubricants ability to initiate the wear mechanism known as micropitting; a common type of wear seen in gears which usually propagates into a more severe failure mode.

The initial resulted will be presented along with an insight to the future work of the project.

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