MEMORANDUM FOR RECORD

NTSB Incident Number: ERA13IA313; Bell 206L-4; N405MR; New York, New York

On January 21, 2016, in response to a draft factual report review, Mr. Jack Johnson from Rolls Royce provided the following:

"At normal engine operating pressures, the volumetric flow rate through the Oil Delivery Tube (piccolo tube) represents roughly 50% of the total engine oil flow. Therefore, any significant blockage of this oil passage would have a correspondingly significant effect on system oil pressure.

Rolls-Royce conducted testing to measure the effect on engine oil system pressure with varying degrees of blockage of the Oil Delivery Tube, simulating a clogged oil filter screen. The testing demonstrated that engine oil pressure was largely unaffected by filter screen blockage up to 55%. However, when testing was conducted with more significant blockage of the oil filter screen, engine oil system pressure increased dramatically.

Testing revealed:
With 90% blockage, engine oil pressure increased approximately 21%.
With 93% blockage, engine oil pressure increased approximately 40%.

Rolls-Royce conducted testing to measure the effect on oil flow rates through an oil filter screen with varying degrees of blockage.

Testing revealed:
With 80% blockage, flow was reduced by 5.87%.
With 90% blockage, flow was reduced by19.39%.
With 93% blockage, flow is reduced by 32.67%.

It should be noted that, in addition to the filter screen blockage, the Oil Delivery Tube itself was also partially blocked, with a measured flow rate approximately 8% below the minimum required flow rate. The cumulative effect of filter screen blockage and Oil Delivery Tube blockage was not tested."

In addition, from an earlier email, dated July 23, 2015:

Regarding No. 2 Bearing Failures:

“The C30R/3 (Kiowa Warrior), C40 (Bell 430), C47B (Bell 407) and C47M (MD-600) engines were experiencing unacceptably high failure rates of the #2 bearing. The failure mode was determined to be a thermal runaway, which was addressed by a redesign of the oil supply jet to the bearing. The C30 engine line has not had such failures.”

Regarding Smoke on Shutdown:

“Typically, smoke on shutdown suggests a worn carbon seal on the #5 bearing, but there can be other causes. (especially since this turbine just came from the shop and the #5 [bearing] was removed/inspected and re-installed.) An improperly serviced external oil check valve can allow oil to seep back into the turbine section. Any air/oil seal within the turbine could pass oil if the oil pressure is high enough to overcome the air pressure across the labyrinth seal.”

Regarding Oil Degradation:

Passed from a Rolls Royce oil specialist, “Oil degradation is often a result of thermal (high temperature) and oxidative (oil churning, oxygen) stresses applied to the oil. A degraded oil can affect the bulk chemical/physical properties of the oil, increase the risk of deposit (coke) within the engine, raise the level of insoluble material suspended within the oil and affect the tribological properties of the fluid. Once the thermal/oxidative stability of oil degrades, it is not reversible. Typical properties that suffer during degradation include increased viscosity, high levels of insoluble particles, increased deposition characteristics, higher TAN (acidity) levels, etc.”

The specialist also noted that visually, it appeared that material could have built up on the screen wires over time, eventually causing blockage, based on the screen pattern in the deposit. Or, perhaps larger slugs of solid debris collected on the screen and were mashed against it due to high oil pressures.

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