Effect of Heat on Endurance Times of Anti-icing Fluids

APS Aviation Inc. (APS) undertook a study to conduct endurance time tests with heated Type II, III and IV fluids and to compare these endurance times with endurance times obtained using the standard test protocol. The objective was met by conducting a series of tests under natural and simulated precipitation conditions. Tests were conducted always in pairs, with one fluid applied heated and the other fluid applied according to the standard protocol.

Fluid endurance time testing during natural snow conditions was conducted at the APS test site located at the Montreal-Trudeau Airport, during the winter of 2004-05. To obtain the necessary fluid endurance time data for the freezing precipitation conditions, testing was carried out at the National Research Council Canada (NRC) Climatic Engineering Facility using a sprayer assembly to simulate the required freezing precipitation conditions. During the winter of 2004-05, 19 comparison tests (38 individual tests) were conducted in snow conditions and 20 comparison tests (40 individual tests) were conducted under freezing precipitation conditions. These tests were carried out with five fluid brands and three fluid types.

The comparative tests conducted during simulated freezing precipitation conditions indicated that fluids applied heated diluted faster than those applied at room temperature. Also, the test temperature played an important role in the results of the comparative tests. At -10°C, heat reduced the endurance time of the fluid, whereas at -3°C, it extended the fluid endurance time. Additionally, there seems to be a variation between the various fluid types tested, substantiating that perhaps the effect of heat is fluid dependent.

The comparative tests conducted during natural snow conditions indicated that, typically, heating the fluid prior to application resulted in shorter endurance times in the case of low dilution fluids, namely Type III fluids. The effect of heat seems to increase the endurance time of Type IV fluids. These findings match the results from similar tests conducted during the 2001-02 winter season.

Due to the limited number of tests conducted under both snow and freezing precipitation conditions, currently there is not sufficient data to enable a solid conclusion on the effect of heat on different fluid types and fluid brands. Therefore, it is recommended that the failure mechanisms be further evaluated and analysed by conducting a new series of comparative tests using different fluid types and dilutions at various temperatures and precipitation rates. Furthermore, a series of tests should be conducted on a wing in order to conclude on the validity of the fluid application protocol.