Fact Sheet

HELICOPTER PREFLIGHT DEICING

PROBLEM

Preflight deicing of aircraft is a serious problem. Frost, snow, freezing drizzle, and freezing rain can cause icing of aerodynamic surfaces, engine inlets, and wind screens. Unless removed, snow and ice may linger after precipitation ends, grounding aircraft for hours to days, depending upon temperature. Accumulations of frozen precipitation are typically removed from fixed-wing aircraft using heated glycol solutions. However, glycol is harmful to the environment, expensive, and potentially damaging to helicopter rotor head components. Newer helicopters with composite blades and fuselage components are susceptible to damage from deicing operations because physical impact, scraping, high temperatures, and rapid thermal cycling may cause delamination. Reports that manual deicing methods can require up to four hours to prepare a single aircraft for flight, and the inefficiency of these methods, justify the need for improved aircraft preflight deicing methods.

SOLUTION

New approaches must be used to remove ice and snow from helicopters. Though prevention of snow and ice accretion using boots, covers, or hangars is the best measure, aircraft often cannot be protected from freezing precipitation. There are thermal methods that do not mechanically damage helicopter blade composites: infrared heating, hot water, and hot air. CRREL, in partnership with the Aviation Applied Technology Directorate (AATD) at Fort Eustis, Virginia, the Directorate of Combat Developments (DCD) at Fort Rucker, Alabama, and through Cooperative Research and Development Agreements (CRDAs) with Robotic Visions Systems, Inc., and Process Technology, Inc., has conducted experiments on Blackhawk helicopters using these three methods and an ice imaging system.

Infrared heaters are used to deice commercial and general aviation fixed-wing aircraft. Tuned to a wavelength where ice and snow absorb most readily, infrared energy heats and melts snow and ice from aircraft surfaces. Exposure of complex surfaces to infrared heaters requires tailoring of heater configuration for specific aircraft. The diversity of exposures, materials, and ice and snow coverage on a helicopter can cause some portions of the aircraft to deice before others. Hot water may be an effective deicer, without the danger of overheating composites, if water temperature is kept sufficiently low. However, hot water deicing is useful only in temperatures near freezing, and if followed by an anti-icing fluid (typically glycol) to prevent refreezing. Experiments with hot air have also demonstrated its efficacy as a deicing agent if air temperatures are kept sufficiently low to prevent overheating of composites. Auxiliary power units (APU) provide a reliable source of hot air, and an aircraft can autonomously deice if bleed air from its own APU is used.

Ice imaging systems help aircrews to determine the amount of ice on an aircraft, and to assess airworthiness after deicing. They also allow deicing to be conducted when light is not available. Ice imaging is necessary during hot water deicing because thin, clear ice and water look alike in natural light.

RESULTS

A joint CRREL/AATD/DCD experiment was conducted in February 1999 to assess the capability and limitations of infrared, hot water, and hot air deicing systems on Blackhawk helicopters. Fifteen organizations participated, with significant contributions by Process Technology and Robotic Vision Systems, Inc., through CRDAs. A report of that experiment is in print as an American Institute of Aeronautics and Astronautics paper. Excessed Blackhawk rotor blades have been acquired for further experimentation, and CRREL is working with Dartmouth College to assess electrical debonding of ice.

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