

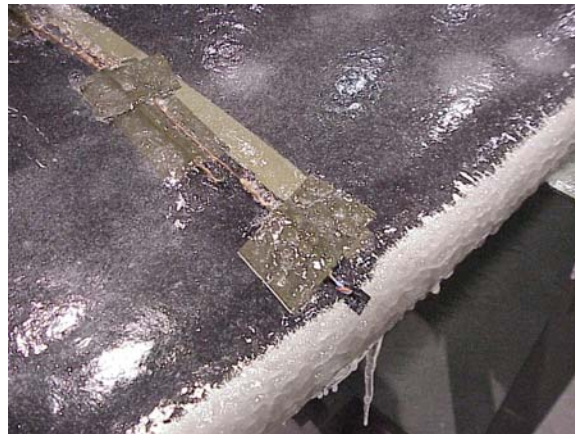


**US Army Corps
of Engineers®**

Engineer Research and
Development Center

Helicopter Preflight Deicing

Problem Preflight deicing of helicopters is critical to military readiness. Helicopters unsheltered by hangars are subject to frost, snow, freezing drizzle, and freezing rain that can cause icing of rotor blades and fuselages, rendering them unflyable until cleaned. Conventional glycol-based deicing fluids used for commercial fixed-wing aircraft are harmful to the environment, expensive, and potentially damaging to helicopter rotor head components. 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. Manual deicing methods requiring up to four hours to prepare a single aircraft for flight, and the inefficiency of these methods, justify the need for improved helicopter preflight deicing methods.



Clear ice covering thermocouple on helicopter blade.

- Description** ERDC's Cold Regions Research and Engineering Laboratory (CRREL) is investigating and developing deicing techniques that meet performance and environmental requirements for use on military rotor wing aircraft:
- ERDC-CRREL has conducted evaluations with the Air Force to optimize the ability of infrared systems to melt ice and snow from aircraft, and to prevent overheating of composite materials.
 - ERDC-CRREL is working with the National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA) to characterize in-flight icing conditions and develop techniques to remotely sense icing.
 - Because icing cloud characteristics affect engine performance, ice shape, and iced airfoil aerodynamics, ERDC-CRREL, in partnership with the National Center for Atmospheric Research and the FAA, is developing methods to characterize the spatial fluctuation of icing cloud liquid water.
 - Ground-based technologies are near prototype by NASA Glenn Research Center (GRC) and the NOAA Environmental Technology Laboratory for remotely detecting icing conditions ahead of aircraft using radar and microwave radiometry.
 - ERDC-CRREL is evaluating a prototype airborne dual-band radiometer system with full polarization in cooperation with NASA-GRC to detect icing and other hazards. An airborne imaging polarimeter system is now in development through CRREL under two Phase II SBIR programs.



Black Hawk helicopter crew clearing snow after unscheduled stop caused by bad weather in Germany. (Photo: Troy Darr, U.S. Army)

Expected Products

- Infrared heaters to allow more rapid removal of ice and snow from aircraft are being described in reports and have been presented on television.
- Techniques to characterize the spatial characteristics of icing cloud liquid water are being developed by ERDC-CRREL.
- Ground-based multiple-sensor icing remote-sensing systems being developed with ERDC partnership will be available from NASA and NOAA to protect airport approach and departure areas within 10 years.
- Airborne systems using radar and microwave radiometry will be available from NASA and ERDC-CRREL within 10–15 years.

Potential Users

Military (AMCOM, USTRANSCOM, NAVAIR) and commercial aircraft developers and operators, and airframe and engine manufacturers will benefit from work under development by ERDC-CRREL. These technologies and techniques will provide more rapid, less expensive, and environmentally acceptable methods of removing ice and snow from aircraft and protecting them from in-flight icing, resulting in improved safety and more efficient operations.

Projected Benefits

Improved methods of characterizing icing and mixed-phase clouds will allow more accurate assessment of the effects of these clouds on aircraft performance. Icing remote sensing systems will reduce the frequency of icing mishaps and accidents, potentially saving millions of dollars and tens of lives annually. Infrared deicing systems have the potential to deice helicopters rapidly and to decrease the environmental impact of aircraft ground deicing.

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