



New FAA Program Tackles Aircraft Icing



Winter in the United States can produce some of the most dangerous weather for the aviation industry, including freezing rain, freezing drizzle and sleet. Those are the ideal conditions for a field campaign focused on collecting in-flight data in some of the most challenging North American icing conditions.

The FAA recently headed the new campaign, In-Cloud ICing and Large-drop Experiment (ICICLE), to collect data in these hazardous aircraft environments to support FAA icing research.

Working with the FAA, the National Research Council of Canada flew a Convair 580 twin-engine research aircraft into forecasted icing conditions. In collaboration with scientists and engineers from Environment and Climate Change Canada and the National Research Council of Canada, the FAA collected extensive environmental measurements using multiple onboard instruments. ICICLE began Jan. 27 and continued through March 8, operating out of Rockford, Illinois, and targeting icy weather in Illinois and its neighboring states.

The program is helping improve weather tools and model forecasts for those who work in aviation, aiming to reduce the rate of aircraft icing-related accidents and fatalities for aircraft operations in the national airspace system.

It is all part of the FAA's Aviation Weather Research Program, which sponsors research that will help minimize the impact of weather on the NAS, including turbulence, ceiling and visibility, thunderstorms, and aircraft icing. The FAA's Aviation Research Division and Aviation Weather Division support ICICLE.

"The data from ICICLE will help develop and validate icing weather tools for the identification of icing conditions an aviation user may encounter, both in the terminal and en route environments, to enable safe operations in the NAS," said Danny Sims, the FAA in-flight icing project lead.

The FAA has been sponsoring the development of national-scale icing products to support the en route domain under the in-flight icing project, as well as the development and testing of new capabilities



The Convair research aircraft in the early morning hours at Rockford (Photo: FAA)

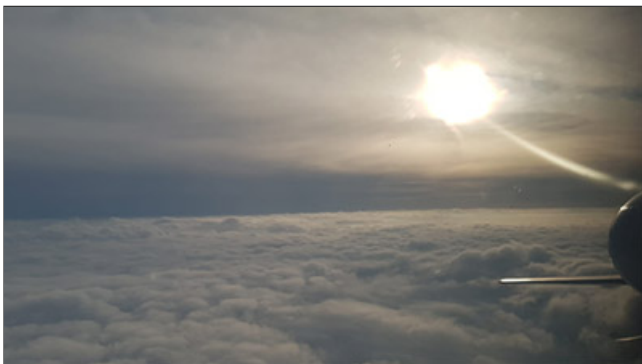


The ice-covered radome after a mission (Photo: FAA)

for the terminal area domain under the Terminal Area Icing Weather Information for NextGen (TAIWIN) research project.

"For pilots, aircraft icing can pose a serious threat," said Stephanie DiVito, the FAA ICICLE program lead and TAIWIN project lead. "For those who need to stay out of icing or certain types of icing, knowing where it does and does not exist is critical to safe operations. Identifying these complex icing environments and forecasting them is difficult, though."

Ben Bernstein, ICICLE science lead and primary operations director, helped identify and forecast icing conditions and guide the aircraft into and out of these conditions. "This flight program targeted a broad spectrum of icing conditions, including supercooled large drops, and focused on challenging transitions in icing that are critical to providing essential icing information to the flying public," Bernstein said.



The Convair flies over icing clouds. (Photo: FAA)

"Because the size and concentration of cloud drops and particles influence the impact of icing on an aircraft, measuring these fields was key," said DiVito.

Special instruments onboard the Convair 580 measured the range of particle sizes and their concentration, including both droplets and ice crystals, throughout takeoff, flight and landing. In addition, onboard cloud and precipitation radars allowed the scientists to characterize the clouds above, below and ahead of the aircraft. Additional instrumentation measured other cloud properties, ice buildup and aerosols.

Throughout the field project, scientists and flight crew typically began work on the flight plan in the early morning. Forecasters started looking at weather conditions as early as midnight, with partnering universities occasionally releasing weather balloons to analyze the cloud structure. The team used the forecasts to plan the flight route and altitudes needed to capture the in-cloud and surrounding conditions. Even if there was no precipitation, the crew flew to encounter ice-prone conditions within the clouds.



Some ICICLE team members at Rockford Airport (Photo: FAA)

The National Center for Atmospheric Research was also a critical partner in the research. During ICICLE, NCAR's expertise in terminal area and in-flight icing conditions supported daily forecasting of weather conditions, flight operations and initial analyses of icing weather tools under evaluation.

A team of forecasters monitored the weather outlook and provided guidance on the best areas in which to direct the aircraft to find icing conditions. NCAR staff also provided support during the flight by monitoring real-time data from satellite, radar and ground-based instrumentation to help direct the aircraft once it was in flight.

Other scientists supporting the program came from many organizations. The National Oceanic and Atmospheric Administration Earth System Research Laboratory provided special runs of forecast models. The NASA Langley Research Center provided relevant icing information from weather satellites. The Desert Research Institute and Meteo-France each provided a forecaster to support ICICLE flight operations. Meteo-France, the UK Met Office and Deutscher Wetterdienst (the German Meteorological Office) also provided scientists to support operations and encourage future collaboration. Universities releasing balloons included Valparaiso, Northern Illinois, Illinois-Urbana Champaign and Iowa State.



Ice-covered Convair after a project flight. (Photo: NCAR)

"There's been a lot of collaboration on this project, with everyone focused on our mission," DiVito said. "The ICICLE program was a major success, and we have collected what looks to be a remarkable dataset that will help us continue to meet the FAA's mission of improving safety in the NAS."

Top photos, clockwise from top left: ICICLE team members mid-program, Feb. 28; a scientist examining icing on a plane; Steph DeVito holding a chunk of ice off one of the aircraft's probes following a flight; and the Convair's windshield covered in ice.