Heat Flux Requirements for Electrified Aircraft Wing Anti-Ice Systems

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Abstract

As the drive for increased efficiency and decreased emissions drives the aviation world towards more electrified aircraft, the availability of excess power or engine bleed air for anti-ice/de-ice of wing leading edges diminishes. The heat requirements necessary for icing protection of the wing should be considered early in the design process to assist in the sizing and design of electric propulsion components and the engines or batteries that drive them.

The heat requirements are primarily dependent on the conditions of the freestream and the shape of the wing. Analysis was performed for the High-efficiency Electrified Aircraft Thermal Research (HEATheR) project. Three representative aircraft configurations were considered in the project: Single-aisle Turboelectric AiRCraft with Aft Boundary Layer propulsion (STARC-ABL), Revolutionary Vertical Lift Technology (RVLT) Tiltwing, and Parallel Electric-Gas Architecture with Synergistic Utilization Scheme (PEGASUS). Initial analysis was performed using LEWICE, a software developed by NASA GRC, to determine the heat requirements necessary to maintain an ice-free surface from the leading edge through the 10% chord. These calculated heat requirements will be used to select an appropriate anti-ice/de-ice architecture and determine the system-level impacts on weight, power, and performance.

Initial analysis is complete for the 3 HEATheR aircraft. Results and proposed future work will be presented.