报告题目：Aerodynamics and Thermal Physics of Helicopter Ice Accretion

报 告 人： Yiqiang Han, Lecturer at Clemson University, SC; Ph.D. EDUCATION at Pennsylvania State University on helicopter icing physics, modeling and detection, a 5-year task funded by US Army National Rotorcraft Technology Center (NRTC).

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地　　点： 上海交通大学，航空航天学院，四楼会议室

Dr. Yiqiang Han is a UAS icing researcher focusing on droplet dynamics, in-situ LWC measurement and icing cloud detection at Clemson University. He received M.S. degree in Aerospace Engineering from Pennsylvania State University in 2011, and continued a Ph.D degree on helicopter icing physics, modeling and detection, a 5-year task funded by US Army National Rotorcraft Technology Center. Her current research interests are in the areas of principal researches of reduced-dimension thermodynamic model, engine ice crystal research, testing, sizing and optimization of rig (open-loop icing wind tunnel) to capture engine ice crystal melting procedure, Simulation of helical gear windage loss, and related application fields. He has authored several publications in AIAA Journal and refereed conference proceedings.

Abstract: In an effort to improve the accuracy of current aircraft ice-accretion prediction tools, experimental and analytical studies have been conducted on airfoils roughened by natural ice accretion. Surface roughness introduced by ice accretion and its effect on surface convective heat transfer have been tested and modeled, based on 10 experimental test cases. A novel scaling coefficient relating the Stanton and Reynolds numbers was introduced for heat transfer comparison and modeling in turbulent regime. By coupling the ice roughness and heat transfer models together with LEWICE ice-accretion tool, an improved ice-accretion model has been achieved. Four experimental ice shapes were obtained at the Adverse Environment Rotor Test Stand laboratory for model validation. The new surface-roughness model had very good agreement in both overall ice shape and ice thickness at the stagnation line (within 5% discrepancy for four experimental cases), whereas LEWICE prediction constantly underestimated the stagnation ice thickness by 30%. The overprediction of ice-horn lengths was also addressed by the proposed model. In one of the glaze-to-rime-regime cases, LEWICE overpredicted the upper and lower horn lengths by 32 and 22%, respectively, whereas the new model prediction resulted in 3% accuracy.

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