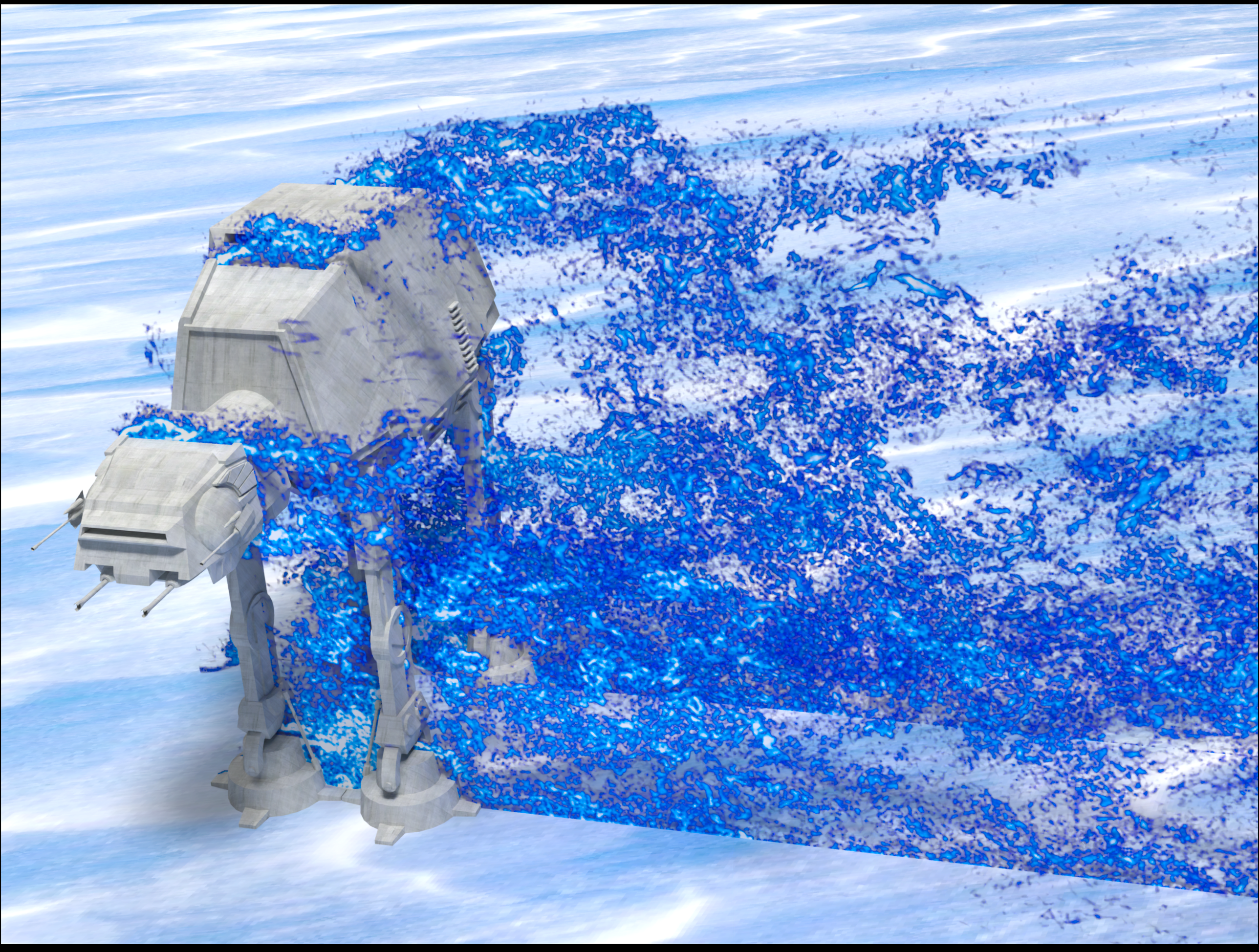
EXTREME EVENTS IN THE BATTLE OF HOTH: MASSIVELY SEPARATED FLOW IN THE AT-AT IMPERIAL WALKER

Yuan Yuan, Gonzalo Arranz, Emily Williams, Yuenong Ling, Rong Ma & Adrián Lozano-Durán
Massachusetts Institute of Technology



During the Battle of Hoth, our Imperial forces, led by AT-AT walkers, conducted a courageous attack on the infamous Rebel base. The AT-ATs were air-dropped onto the snowfield and successfully annihilated the Rebel defenses. In this final report, it is concluded that The AT-ATs' armor satisfactorily withstood the Rebel firepower. However, confronted with the strong crosswind in the field, a potential design flaw was identified in the AT-AT baseline model. AT-AT walkers experienced massively separated flow, which resulted in the toppling over of a handful of units.

To analyze the problem, wall-modeled large-eddy simulation was conducted to test the stability of the AT-AT under extreme crosswind conditions. The crosswind speed selected was 31.5 m/s, which corresponds to a Reynolds number of 4e7. The flow separation is visualized above by contouring the vorticity magnitude. The aerodynamic forces predicted were used to estimate the total moment balance of the AT-AT. It was found that, under extreme wind conditions, the resulting torque can jeopardize the AT-AT's ground stability. A wider spanwise leg-to-leg clearance is recommended for future designs of the AT-AT.

MIT AEROASTRO