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An Evaluation of Droplet Breakup Characteristics for Low- and High-Speed Vehicle Impacts MICHAEL KINZEL, University of Central Florida, JASON TURNER, University of of Illinois Urbana Champagne, BRENDON CAVAINOLO, CAROLINE ANDERSON, University of Central Florida, UIUC TEAM, CFAL TEAM — In this work, computational fluid dynamics (CFD) predictions are used to simulate and study the evolution of a droplet in its approach of aerodynamic surfaces. The CFD effort is based on the volume-of-fluid (VOF) method in a formulation that contains the compressibility of both the liquid and gas. Using this formulation, the calculations of the breakdown of the droplet on impingement are directly simulated. These studies include evaluations of both low-speed subsonic and high-speed hypersonic interactions. These conditions are drastically different as low-speed cases involve a graduate build-up of slip velocity between the gas and droplet. Whereas high-speed impacts involve shock interactions. The traditional scaling parameter used in this scenario is the Weber number, but the present CFD indicate that cavitation also plays an important role. For this reason, the effort explores cavitation scaling parameters for high-speed droplet breakup as well. The overall effort presents prediction results, interpretation of the results, and evaluation of the cavitation scaling parameter.

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