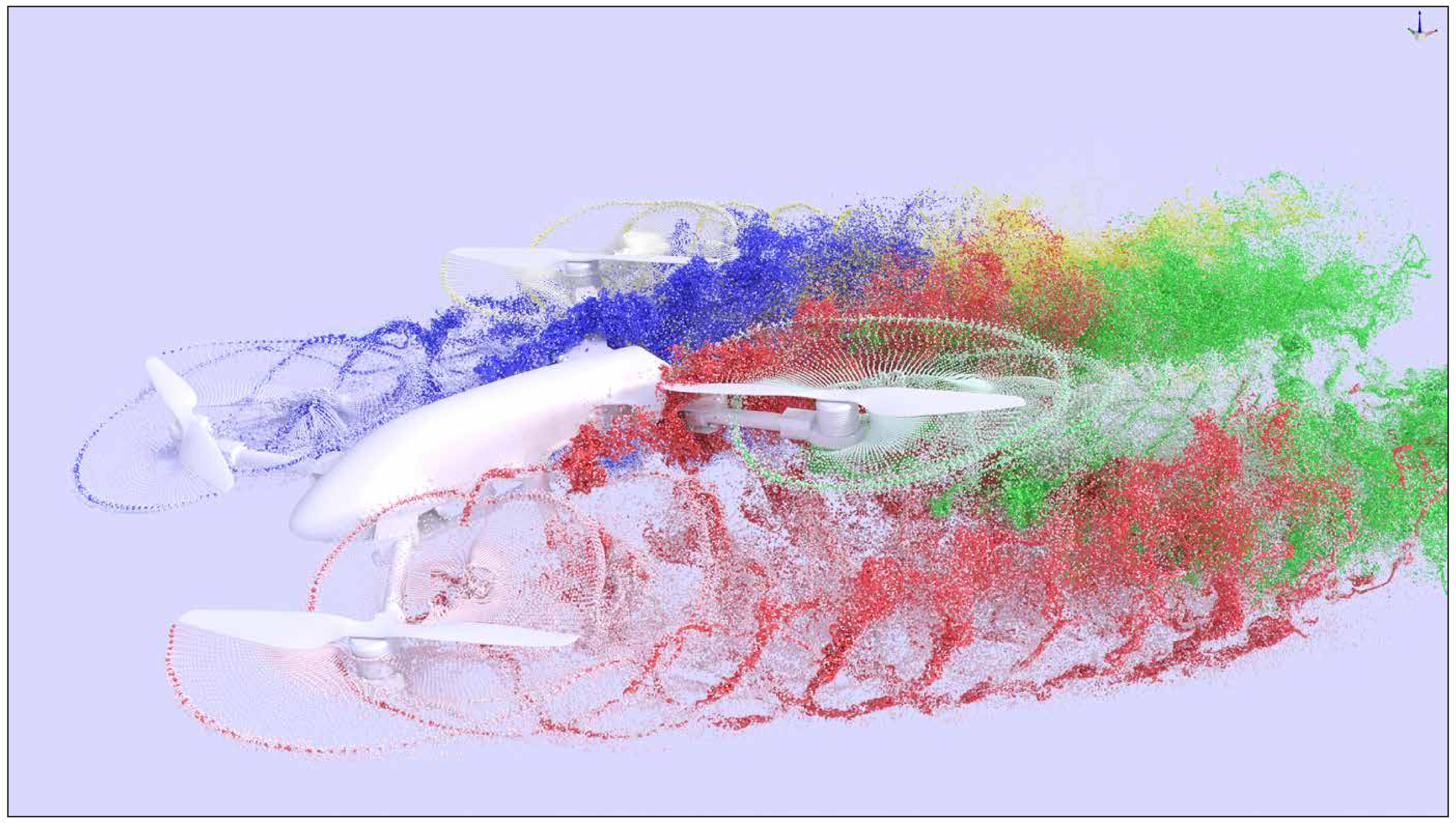
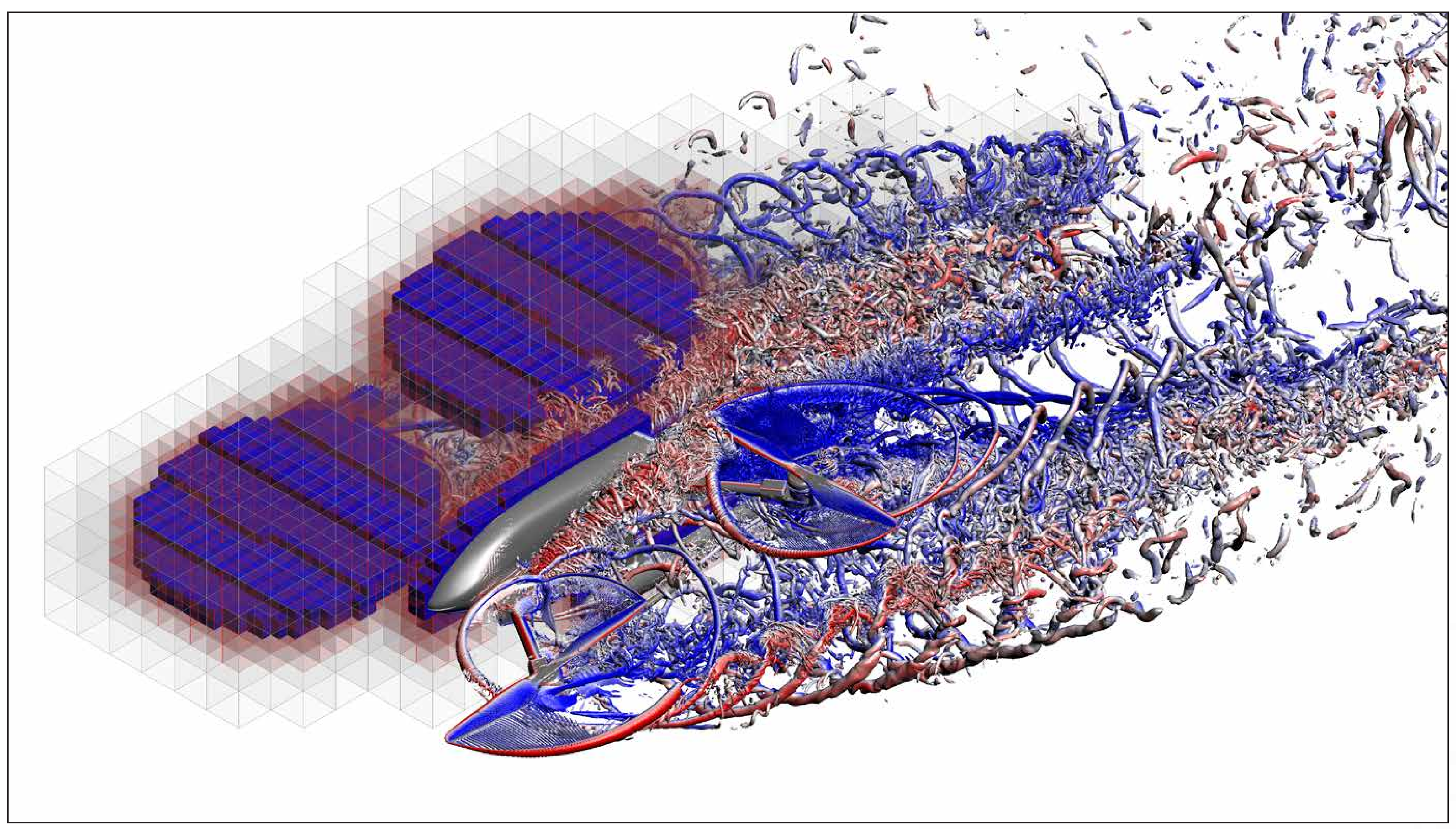
National Aeronautics and
Space Administration



Passive particles tracing the complex flow structures generated by four sets of blades spinning at 133.1, 134.9, 163.2, and 164.6 Hz. This 5% tip chord simulation of a Straight Up Imaging (SUI) quadcopter in forward flight was conducted using NASA's high-performance LAVA Lattice-Boltzmann flow solver. *Francois Cadieux, Timothy Sandstrom, NASA/Ames*



Isosurfaces of Q-criterion colored by vertical velocity (blue is up-, red is down-flowing), from the SUI quadcopter simulation. Block-structured adaptive mesh refinement boxes are displayed only on one side of the vehicle, where the blue boxes indicate the finest level, coarsening to gray boxes. These recursively nested boxes are automatically clustered/refined by the algorithm in regions of geometric importance and elevated turbulence statistics. *Michael Barad, Francois Cadieux, NASA/Ames*

Predicting Quadcopter Drone Noise Using the Lattice Boltzmann Method

The market for new vertical takeoff and landing vehicles, including autonomous urban air taxis and drones for applications such as package delivery, imaging, and surveillance, is growing rapidly. However, aerodynamic noise continues to be the biggest roadblock to community acceptance and adoption. To predict the aerodynamic noise generated by an isolated quadcopter drone, derived from from first principles, we used the Lattice Boltzmann flow solver within NASA's Launch Ascent and Vehicle Aerodynamics (LAVA) solver framework. The solver's computational efficiency, and the complete absence of labor-intensive manual volume mesh generation in the work-flow, are key to making routine aeroacoustic analysis of urban air taxis and drones from first principles possible.

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