Our primary goal is to increase the predictive use of high-fidelity computational aero-acoustics (CAA) capabilities for NASA’s next-generation aviation concepts. Although computational fluid dynamic methods have been used substantially in analysis and design for steady-state problems, computational resources are extremely challenged for high-fidelity unsteady problems—such as unsteady loads, buffet boundary, jet and installation noise, fan noise, active flow control, and airframe noise. To achieve our goal, we need new techniques for: reducing the resources used by current high-fidelity CAA; routine acoustic analysis of aircraft components at full-scale Reynolds numbers from first principles; and an order-of-magnitude reduction in wall-time-to-solution. Lattice-Boltzmann methods can deliver all of these requirements.