In the past twenty years, there has been a renewed interest in supersonic civil aircraft. The first generation of such configurations was forced to fly subsonically over land to avoid sonic boom annoyance, which contributed significantly to their commercial failure. Advances in aerodynamics, materials, and propulsion, together with a rising demand for fast long-distance travel, have driven this renewed interest. Consequently, there is a growing need for methods that support the design of high-speed aircraft while accounting for environmental impact. This work focuses on improving the prediction of sonic booms and providing guidance to both aircraft designers and regulatory agencies. The approach combines high-fidelity CFD simulations near the aircraft with the propagation of sonic boom signals through a stratified, non-uniform atmosphere. The numerical methods were tested against two experimental free-flight campaigns on sub-scaled models, showing deviations of around 1 dB between predictions and measurements, which confirms the accuracy of the proposed approach. The methodology covers the entire supersonic flight range, from Mach 1.5 to Mach 5.0 with several case studies. To assess the behavior of such configurations in off-design conditions, psychoacoustic, energy-based metrics and primary carpet extension were analyzed, providing quantitative data to inform the development of overland noise regulations for high-speed civil flights. The influence of different turbulence models in the CFD region on sonic boom metrics was also investigated to ensure robust and comprehensive assessments across diverse flight conditions. Since 1973, a ban for supersonic overland flight exists, but recently, President Trump signed an executive order to promote supersonic aviation in the United States. For that reason, it is important to work towards the definition of a specific certification standard, considering the whole supersonic flight envelope. Two practical tools were developed to support early-stage design. A sonic boom requirement was added to the Matching Chart tool for aircraft up to Mach 2, and a refined analytical method based on the simplified Carlson approach was proposed and validated. Together, these tools allow designers without sonic boom knowledge to consider aeroacoustic requirements from the beginning of the design process, supporting future regulatory efforts on overland sonic boom standards.