In many aeroacoustics applications involving nonlinear waves and obstructions in the far-field, approaches based on the classical acoustic analogy theory or the linearised Euler equations are unable to fully characterise the acoustic field. Therefore, computational aeroacoustics hybrid methods that incorporate nonlinear wave propagation have to be constructed. In this study, a hybrid approach coupling Navier–Stokes equations in the acoustic source region with nonlinear Euler equations in the acoustic propagation region is introduced and tested. The full Navier–Stokes equations are solved in the source region to identify the acoustic sources. The flow variables of interest are then transferred from the source region to the acoustic propagation region, where the full nonlinear Euler equations with source terms are solved. The transition between the two regions is made through a buffer zone where the flow variables are penalised via a source term added to the Euler equations. Tests were conducted on simple acoustic and vorticity disturbances, two-dimensional jets (Mach 0.9 and 2), and a three-dimensional jet (Mach 1.5), impinging on a wall. The method is proven to be effective and accurate in predicting sound pressure levels associated with the propagation of linear and nonlinear waves in the near- and far-field regions.