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Jet noise from large-scale turbulent structures

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The generation sound by large-scale turbulent structures in jets, where the structures are convecting supersonically with respect to the ambient speed of sound, is well understood. The pressure pattern generated by the large-scale structures couples directly with the radiated sound field. An instability wave model for the development of the large-scale structures gives excellent predictions of both the near and far acoustic fields. However, when the structures are convecting subsonically, there is no general agreement as to how or even whether they generate any noise directly. Recent experimental evidence has shown a remarkable similarity between the jet noise spectra in the vicinity of the peak noise radiation direction for both subsonic and supersonic jets. This suggests that the large-scale structures do contribute directly to jet noise radiation at all jet operating conditions. In the present paper a model is developed for the noise generation mechanism. Using experimental measurements of the far field noise, the near field pressure pattern required to generate the noise can then be calculated. The question of whether this pattern is consistent with a reasonable physical model for the evolution of the large-scale turbulent structures is then discussed.