

Modeling Sonic Booms in Supersonic Military Airspace

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Sonic boom is the impulsive noise generated by an aircraft or other object moving faster than the speed of sound. A supersonic aircraft continuously generates sonic boom waves that propagate outward in a conical pattern, much like the bow wave of a boat, except in three dimensions. Sonic booms usually sound like two sharp cracks a fraction of a second apart. The first crack is associated with the forward part of the aircraft, and the second with the rear. The amplitude of the cracks depends primarily on the altitude and size of the aircraft, and also whether the aircraft is maneuvering. The area on the ground that is impacted by sonic booms is referred to as a "footprint," or for continuous steady flight as a "carpet." Validated theory for predicting individual sonic booms has been established for some time, and has been embodied in computer programs for over 30 years. PCBoom4, developed by Wyle Laboratories for the US Air Force, is a user-friendly program that will compute complete sonic boom footprints for individual events.

Supersonic operations in military airspaces generally consists of brief, seemingly random, supersonic events during various types of training exercises. These are not amenable to single event analysis, but long-term exposure can be modeled statistically. BooMap is a sonic boom model for supersonic military operating areas, developed from long-term (three to six month) sonic boom monitoring projects in four airspaces. It provides annual or seasonal average exposure together with statistical distributions of the expected numbers and amplitudes of sonic booms.

This presentation will review the basic properties of sonic booms, and their occurrence in military airspace. This will include the physics of sonic boom generation and propagation, the effects of atmospheric conditions and maneuvers on sonic booms, the statistical nature of sonic booms from military flight operations, and the effects of sonic booms on people and structures. Application of PCBoom4 and BooMap to military airspace will be discussed.

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