'Urban canyons' prolong sonic booms in cities

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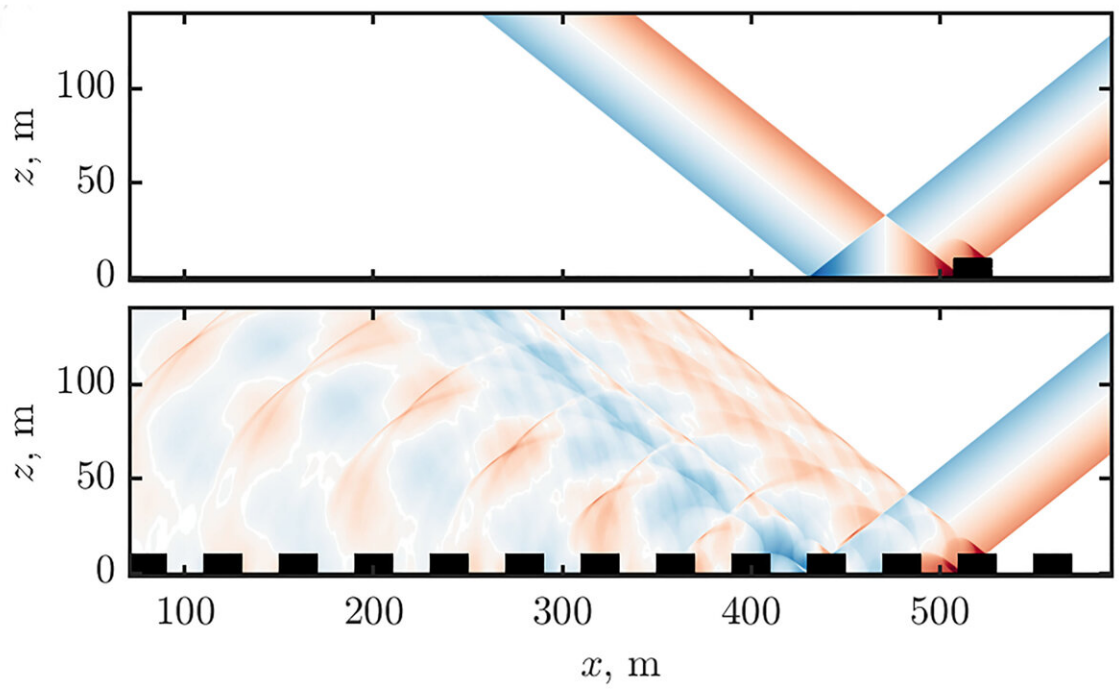

Propagation of an N-wave sonic boom above (a) an isolated building and (b) multiple buildings. Credit: Didier Dragna

Twenty years after the retirement of the Concorde, several industrial and research projects want to make supersonic flight a reality again. However, supersonic planes produce sonic booms loud enough to warrant noise concerns and regulations, limiting their use over land.

In *The Journal of the Acoustical Society of America*, University of Lyon researchers conducted simulations comparing how sonic booms reflect differently over a single building, two neighboring buildings, and multiple buildings spaced at regular intervals.

"This paper is the first study to address the propagation of the boom in an urban environment," said co-author Didier Dragna. "The resonance phenomenon in an urban canyon has been shed to light for sonic boom, and its importance has been quantified."

The Federal Aviation Administration currently prohibits commercial aircraft from traveling faster than Mach 1 over land and from a certain distance offshore where a boom can reach U.S. shores. Recent efforts have sought to make low-boom supersonic aircraft, but noise issues due to sonic booms may become more pronounced in cities, where buildings form canyons that distort the booms.

The group performed numerical simulations drawing on equations from the field of fluid dynamics to predict the boom in different urban configurations.

"This approach allows us to precisely account for the reflection of the boom on streets and facades of the buildings," Dragna said. "With these simulations, we were able to determine the ground pressure signals due to sonic boom propagation and reflection over the buildings and deduce noise levels. We can thus predict the noise annoyance felt by the population due to sonic booms."

The researchers found the wider the streets compared to the height of buildings, the less booms are affected by the presence of several buildings.

Narrower streets introduce more complex boom propagation through

multiple reflections on building facades. While they don't affect boom loudness, they tend to prolong the pressure signals at ground level in urban canyons through increased resonance between buildings.

Dragna said their research underscores the importance of the shape of cities for the characteristics of sonic booms at ground level. The group aims at investigating the phenomenon further by looking into typical city configurations.

The article is titled "Sonic boom reflection over an isolated building and multiple buildings."

More information: Sonic boom reflection over an isolated building and multiple buildings, *The Journal of the Acoustical Society of America* (2022). DOI: 10.1121/10.0010452

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