



Regulation and norm for low sonic Boom Levels

INTRODUCTION

RUMBLE is a H2020 collaborative project dedicated to the production of the scientific evidence requested by national, European and international regulatory authorities to determine the acceptable level of overland sonic booms and the appropriate ways to comply with it. RUMBLE does not aim at producing a low boom aircraft design but rather the quantified evidence needed to support new regulations.

To this end, RUMBLE associates the leading organisations in supersonic aviation in Europe and Russia, combining scientific excellence, world-class research infrastructures and industrial leadership bearing the heritage from Concorde and Tu-144, with strong involvement in the regulatory bodies. Nearly 17 years after the last commercial supersonic flight, the quick evolution of technology combined with the emergence of ambitious industrial projects indicate that a second era for environmentally-friendly supersonic commercial flights is about to happen.

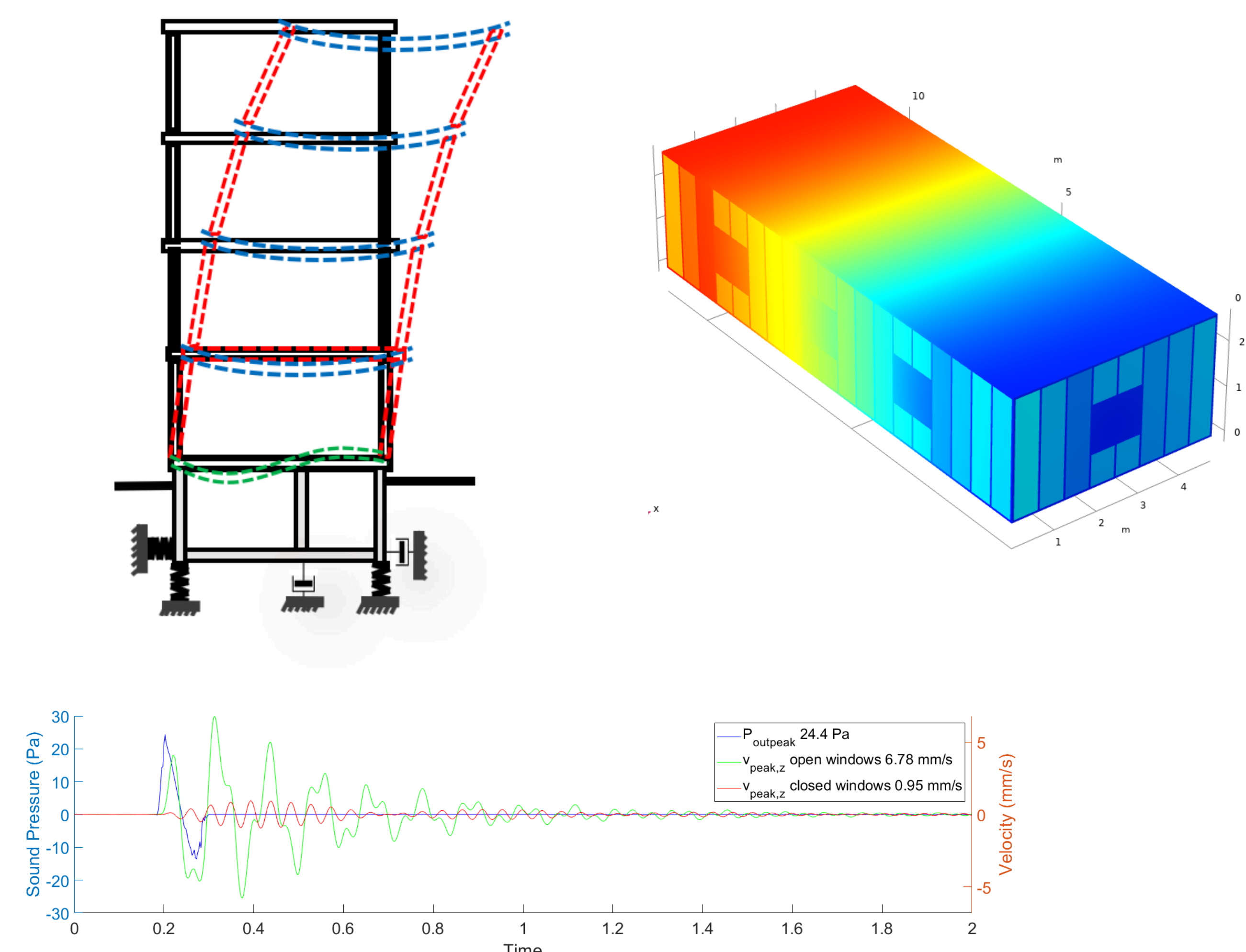
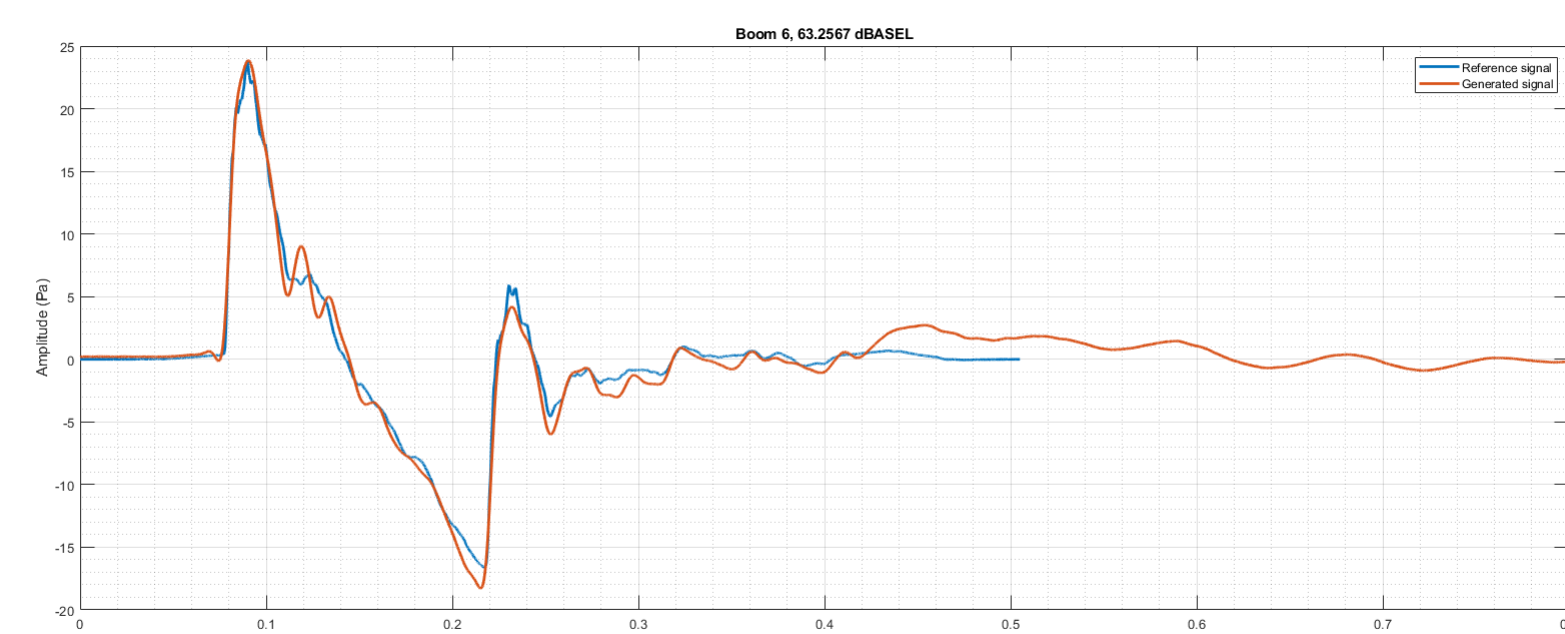
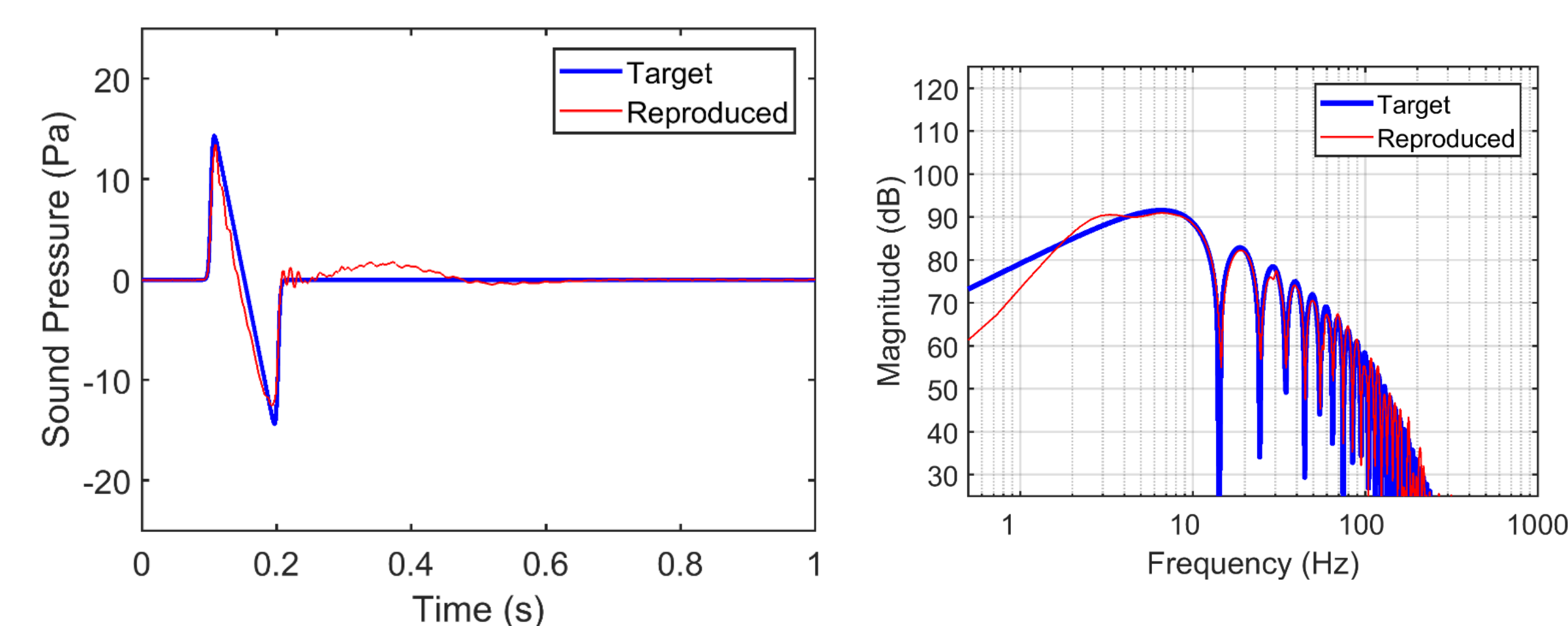
Since then “low-boom” technologies have emerged, opening the door to regulatory evolutions.

One of the main obstacles remaining on the path to sustainable supersonic commercial flight is the issue of noise, specifically the loud and sudden sonic boom felt by the populations overflown during the entire cruise. The high level of sonic boom produced by supersonic aircraft at the time led to a complete ban of civilian supersonic flights over land in the United States and several other countries.

PROBLEM STATEMENT

Precise quantification of the correlation between low sonic boom exposure and human response is beyond today's knowledge for the following reasons.

- Sonic boom accurate precision remains out of today's routine procedure in several situations: lateral boom, turbulent atmosphere, non-flat ground.
- Past studies have relied on either Concorde experience or flight tests with military fighters, whose ground booms are unable to reproduced the expected characteristics of a future low-boom civil aircraft (low amplitude, non N-wave shape, multiple small amplitude smeared out shocks, dampened high-frequency content).
- The human response has been assessed mainly through exposure within boom artificial simulators, far from the conditions of ‘ecological validity’ of real boom experience (during daily life in a usual home, work or social environment).
- Most recent studies correlating human response to boom levels implied only subjects from Japan or USA exposed inside boom booth or “typical” American light-wooden houses, a population not necessarily representative of the world population/buildings, and especially of the European ones.
- Studies on potential sleep disturbances are too old, too partial and implied to a few subject people.



OBJECTIVES

The high-level objective of RUMBLE is to support the European contribution to a regulatory standard for low sonic boom at the United Nations’ International Civil Aviation Organisation, on an equal footing with other key countries:

- To reach this high-level objective, RUMBLE addresses the following scientific and technological objectives:
- To develop advanced numerical models and tools to predict the boom generation, its propagation through the atmosphere and the induced building vibratory response.
- To provide quantitative information on the human response to outdoor and indoor low sonic boom;
- To identify relevant flight procedures and instrumentation for low-boom impact assessment;
- To provide recommendations for a future low-boom flying demonstrator;
- To produce recommendations for future low-boom standards;
- The RUMBLE consortium gathers the best-skilled organisation in Europe and Russia, the only two industries ever able to designing and operating a civil supersonic aircraft, to achieve these objectives.

IMPACT

The primary outcomes of RUMBLE will be societal and environmental, as it will provide the necessary data and procedure for a future, internationally-agreed standard on low sonic boom supersonic flights overland. This standard will help protect the European citizens’ quality of life by guaranteeing, in agreement with ICAO general resolution 33-7, that no unacceptable situation is created by supersonic commercial flights.

