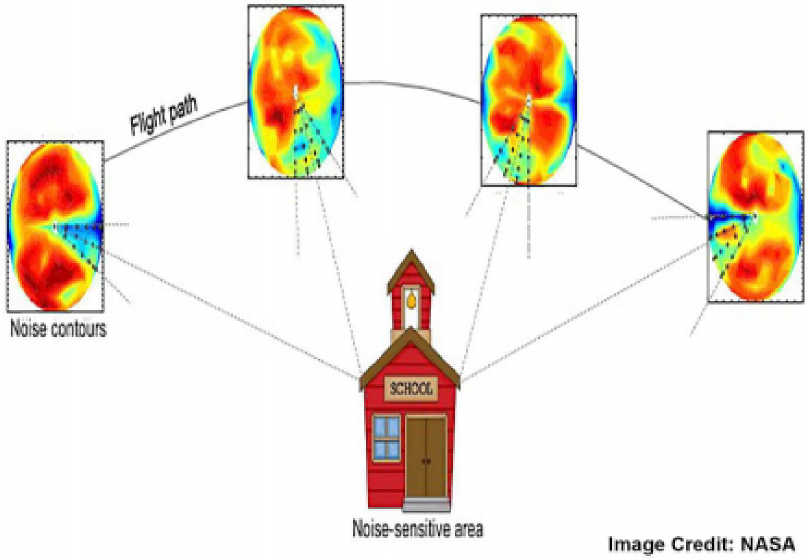


Image Credit: NASA

National Aeronautics and
Space Administration

Aeronautics

Propeller/Rotor Phase Control for Reduction of Community Noise from Distributed Propulsion Vehicles

Method of adjusting relative angular positions of propeller and/or rotor blades to modify the spatial distribution of noise

Community noise has been identified as a major barrier to entry-into-service of unmanned aerial vehicles (UAVs) and urban air mobility (UAM) platforms. For these applications, distributed electric propulsion (DEP) systems are becoming increasingly popular because of their ability to distribute propulsors in many locations on the vehicle. New small/medium UAV's and UAM's, and thin/short haul aircraft concepts and demonstrators exploit DEP systems for different purposes. However, given the problem of community noise, NASA engineers have modified the vehicle noise directivity pattern by controlling the relative angular positions of the propulsors blades, in order to direct noise away from sensitive areas.

BENEFITS

- Calculations can be completed prior to flight to determine propeller/rotor angles necessary to achieve the noise objective
- Very little additional hardware is needed
- Vehicle flight speed is less restricted if noise can be controlled
- Redirection of air traffic around noise-sensitive areas would be minimal
- Minimizes time-to-destination and energy consumption

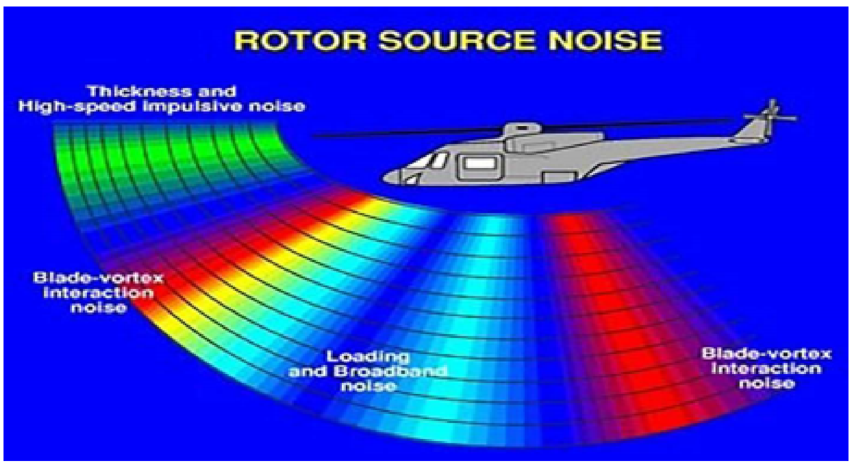
APPLICATIONS

- Noise abatement system for aviation
- Industrial noise abatement (fans & rotors)
- Drones used in factories and warehouses
- Drones used for military operations requiring silence

technology solution

THE TECHNOLOGY

This innovation comprises a method of adjusting the relative angular positions of the propeller and/or rotor blades from a distributed propulsion system to favorably modify the spatial distribution of noise emanated by the vehicle, that is, the directivity pattern, for the purpose of reducing community noise. Adjusting these angular positions shows a great ability to act as a noise-canceling technique by way of destructive wave interference. Effectively, the acoustic energy can be steered away from noise-sensitive areas, e.g., schools, communities, etc. In the initial implementation, the phase angles can be calculated prior to flight. These depend on the propeller/rotor rotation rate, observer location, and relative propeller/rotor spacing, the latter being constant for a given vehicle. Optimization techniques determine the set of phase angles over the parametric space.



Causes of rotor noise. Image Credit: NASA

PUBLICATIONS

Patent Pending