CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
J0102

Project Title
Silent Rotor Blades: Reducing Noise Output of Rotor Blades by Incorporating Noise-Dampening Features of an Owl's Feather

Abstract

Objectives/Goals
Rotor blades used in many home appliances, electronic equipment, and aircraft contribute to significant amounts of noise pollution, which negatively affects people's quality of life can be costly to mitigate. My goal was to design a rotor blade that is quieter than a conventional blade by incorporating noise-dampening morphological features of an owl#s flight feather into the blade design.

Methods/Materials
After doing background research, I borrowed several owl flight feathers from Santa Clara Valley Audubon Society and took photos of their special features under a microscope. Using a laptop computer and Maya 2016 software, I designed a control blade and two modified blades: one with serrated attachments on the leading and trailing edges, the other - with attachments and a fabric blade covering. I then 3-D printed the three blades and set up a testing station, which included a foam stand, an electric motor, two alligator clips, an iPhone with a decibel meter app, and a 12V battery. I controlled for background noise, then measured noise output of the motor w/out a blade, with the control blade, with modified blade #1, and with modified blade #2. I documented my research by taking photos and recording the data in my project notebook. NOTE: I am currently working on a set of modified blades for a quadcopter (FAA registered). I plan on testing their in-flight performance and including the results in my project.

Results
Modified blade #1, which incorporated two noise-dampening features of an owl flight feather (leading edge serrations and a trailing edge fringe) was on average 71% quieter than the control blade.
Modified blade #2, which incorporated three noise-dampening features of an owl flight feather (leading edge serrations, a trailing edge fringe, and a soft covering) was on average 100% quieter - virtually silent!

Conclusions/Discussion
The silent rotor blade modeled after an owl#s flight feather has potential for being widely used in civil and military engineering:
1.Reducing ambient and environmental noise from axial fans in home appliances and electronics, AC, and whole house fans.
2.Reducing noise pollution from aircraft and inside of aircraft cabins.
3. Military applications could include increasing the stealth of manned and unmanned aircraft.
Further research is needed in order to identify materials suitable for producing the modified blades.

Summary Statement
I was able to design rotor blades that are virtually silent by incorporating noise-dampening features of an owl's flight feather into their design.

Help Received
Mrs. Nancy Franklin, VCJH Technology Department Chair - making the school's 3D printer available for me to print and re-print the blades; Santa Clara Valley Audubon Society - lending owl flight feathers (with permit);my mom and dad -getting the necessary supplies and supporting me