Mark N Callender, J Aeronaut Aerospace Eng 2017, 6:3 (Suppl)
DOI: 10.4172/2168-9792-C1-019

UAS rotor sound pressure level reduction through leading edge, upper surface, and trailing edge modification

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Manned aviation is regulated by the Federal Aviation Administration (FAA) in order to provide for safe, secure, efficient, and environmentally responsible aviation in the United States. One environmental issue regulated by the FAA is the noise created by aircraft. Federal Aviation Regulation (FAR) Title 14 Part 36 deals specifically with sound pressure levels (SPL) according to aircraft type when the aircraft are in close proximity to the ground. Minimizing aircraft noise helps to maintain positive relationships between the aviation community and the general public. Unmanned aircraft systems (UAS) are a very rapidly growing segment of the aviation industry within the National Airspace System (NAS); however, there is currently no regulation for UAS SPL. The UAS are regulated, as of August 29, 2016 such that they are mandated to be in close proximity to the ground (no higher than 400 ft). As with manned aircraft, UAS produce high levels of SPL, much of which is due to the rotors. The combination of close proximity to the ground, high SPL, and increasing UAS density will most certainly result in a negative public reaction. In order to minimize the audible impact of UAS, the author sought to minimize the SPL of small UAS propellers/rotors via leading edge, upper surface, and trailing edge modifications. The results of one type of leading edge modification were previously presented. Continued modifications consisted of additional leading edge combs, an upper surface fabric coating, and a trailing edge fabric tufting. These modifications were inspired by the three characteristics found on the flight feathers of certain owls. The modifications were evaluated individually and as a composite.

Biography

Mark N Callender earned a BS in Aerospace from Middle Tennessee State University (MTSU), an MS in Aviation Systems from the University of Tennessee Space Institute (UTSI), and a PhD in Engineering Science, with emphases in Thermal and Fluid Mechanics, from UTSI. He worked as a Flight Test Engineer for the US Army Technical Test Center (ATTC) conducting performance and systems flight testing of various Army aircraft. He is currently an Assistant Professor of Aerospace at MTSU where he co-ordinates the aerospace technology concentration and teaches aerodynamics and aircraft performance and provides research mentorship to undergraduate and graduate students. His research interests include low Reynolds number fluid mechanics, active and passive flow control, micro air vehicle (MAV) lift production, force balance design, propeller sound reduction, the philosophy of time, and Christian apologetics.

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