ABSTRACT

The traffic congestion in the Dallas-Fort Worth (DFW) region has reached an all-time high and continues to rise. The aim of this report is to conceptualize a UAM (Urban Air Mobility) vehicle that can transport commuters in the Dallas Fort Worth area via an air metro system in order to decrease traffic congestion and commute time. The UAM vehicle is designed from scratch, using data from similar aircraft and a methodology for preliminary design outlined by Dr. Jan Roskam in his Airplane Design Series as starting points for developing a unique UAM aircraft. This process involves performing a market study of the region, formulating the mission profile, choosing a configuration, conducting preliminary sizing of the UAM, selecting the propulsion systems based on preliminary power estimates, implementing the avionics systems, weight and balance estimation, and estimating costs of maintenance/manufacture. We then seek to prove feasibility of the design by analyzing the stability and control, aerodynamics, and overall aircraft performance in prevalent wind conditions. The resulting product is the conceptual design of a feasible tilt rotor, electric vertical take-off and landing (eVTOL), cantilever, high wing aircraft with retractable landing gears. The vehicle has a payload maximum of 981 lbs, allowing for one pilot and four passengers with minimal luggage, and a range of 62 miles, allowing it to transport passengers from the east end of Fort Worth to the west end of Dallas. It utilizes a four tilt rotor propulsion system powered by the 1876 horsepower brushless electric motors with a supply of 1358.27 pounds of Lithium Sulfur batteries, allowing for a cruise speed of 200 mph. The front rotors contain two contra-rotating propellers at a larger size than the rear single propeller rotors. Both the rear and forward propeller systems utilize a gearbox connection to the propulsion systems to keep revolutions per minute and thus torque to more efficient values. Highly active feedback control systems also help keep this aircraft steady in high wind environments while standard collision detectors help the pilot identify buildings in low visibility conditions. Standard deicing solutions are also used to ensure the aircraft remains operable in freezing conditions. The Xiphos is distinct among other UAMs due to its high cruise speed, its relatively low drag design, and its effective use of a small number of rotors/propellers. The Xiphos represents a very possible solution to the growing traffic congestion problems in urban areas