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**Master Thesis Defense**

Entitled

*INFLUENCING FACTORS OF IONIC-WIND IN A SPHERICAL STRUCTURE PROPULSION SYSTEM  
FOR SILENT AIRPLANE*

by

Tha'er Rizek (Shekh Ibrahim)

Faculty Advisor

Prof. Mahmoud F. Al Ahmad, Electrical and Communication Engineering Department  
College of Engineering

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Abstract

For years, scientists from several countries seek exploring the red planet and indeed they are racing to collect and analyze the data on Martian atmosphere. UAE has launched its first “Emirates Mars Mission” (EMM) to Mars successfully on July 20, 2020. EMM known as a “Hope Probe” provide many researchers to have access to data to enable their investigation for the red planet's atmosphere. Hope Probe mission goes beyond the impossible to figure out the possibility of life on MARS. Concurrently with that, NASA designed and successfully flew the “Ingenuity” MARS Helicopter on 19 April 2021. MARS Helicopter is supposed to climbed about 10 feet (3 meters) above the MARS ground, hovered in the air briefly, completed a turn, and then landed. Current airplane design are flying the help of moving parts such as propellers, turbine blades, or fans. Recently, ionic wind-induced by Direct-current (DC) Corona discharge have been introduced to enhance the future generation of airplanes without the need for moving objects. Corona discharge phenomena occurs when high potential differences of the order of tens of kilovolts between two asymmetrical electrodes do exists, which enable the generation of electrohydrodynamic (EHD) thrust in the air. As of now, no “ion” airplane with such a solid-state propulsion system has yet flown. Hence, this study takes a close outlook to investigate such possibility. This work examines the use of a multi-directional thruster integrated in an airplane structure to enhance its flying performance. The proposed design is of spherical shape that incorporates several couple of layers to generate the required ionic wind distribution. The designed airplane is composed of a body that contains the pilot cabinet with all required control and sensory systems. The body is attached by four propellers (ionic wind generators) to provide the required thrust and direction. Each propeller consists of two spheres: outer sphere and inner one. The outer sphere is a sector of distributed multi-needle electrodes. The inner sphere is shaped like a net/mesh. The outer sphere is connected to positive polarity, while the inner is connected to the negative polarity of a voltage source. This arrangement will result in the generation of a strong electric field region to ionize the surrounding gases in the gap between both spheres. The generated ions will travel from the positive outer towards the negative inner mesh which will collide the neutral atoms on the way and generate the required wind, based on established design, which will be assembled with many ionic wind producers as a sectors of sphere, the power supply for each sector will be connected to a controller to control which sector to be on and which one to be off, it will be working as a switcher, then based on selected sectors, the direction of flight will be controlled accordingly.

**Keywords:** Corona discharge, electrostatic field, gap discharge, ionic wind, propulsion, silent airplane, multi-needle-to-net electrodes.