ABSTRACT

In aerodynamics, heat and mass transfer in *John D. Anderson model* is a topic of great interest. At the present, huge amount of money is being invested in spacecraft and the analysis of flow over the moving object furnish very crucial information. It helps a lot to the vehicle designers.

One of the major design goal includes reduced drag which is highly dependent on the shape of vehicle. Reason being, flow of air across the body causes separation of flow which in turn makes the flow turbulent. Furthermore these pressure zones increases the induced drag. Indeed, decrease in drag increases the fuel economy.

In the last decades, efforts are lad on the study of vehicle aerodynamics computationally. This thesis focus on a numerical simulation of heat and mass transfer and CFD based lift and drag prediction over the body surface. In the present study, along with heat and mass transfer, flying qualities of ATD test campaign and design of wind tunnel (open and close) is also analyzed. Due to rapid developments in computer hardware and lack of actual flight data with conventional wind tunnel experiment, efforts are invested in the study of aerodynamic characteristics computationally.

Purpose of this thesis is to evaluate the aerodynamic parameters which affects the heat and mass transfer and the techniques whose analysis provides a way to minimize the heat and mass transfer in aerodynamic space vehicle. Aerodynamic efficiency of a vehicle can be predicted exactly by using the method described in the thesis. It provides sufficient data for wind tunnel parameters which can be directly used. In the exploration of aerodynamic work it renders a lot of information.

Now the things can be visualized in a better way with increased efficiency and performance. Interaction of flow field with matter and within thin regions of boundary is described in a new perspective. Concept of boundary layer with body surface of vehicle is analyzed in depth and results are quite fair with experiment results. In aerodynamic vehicle construction, designing and evaluation of heat and mass transfer, it can prove a milestone. Different approaches of new techniques are applied to present model in a systematically way and can also be implemented to the similar problem.