

## KEYNOTE LECTURE

### AN OVERVIEW OF LAUNCH VEHICLE AERODYNAMICS AND AERO THERMAL ASPECTS



#### **S. Pandian**

Deputy Director  
Vikram Sarabhai Space Centre  
Indian Space Research Organization

Shri S Pandian graduated from Madras Institute of Technology in 1982 and did his Master degree in Aerospace Engineering at Indian Institute of Science, Bangalore in 1984. Since then he is working at Vikram Sarabhai Space Centre, Indian Space Research Organization, Trivandrum. He has been responsible for the aerodynamic design and characterization of launch vehicles (ASLV, PSLV, GSLV, LVM III, Sounding Rockets, Air Breathing Vehicle, Reentry modules, RLV).

He is Deputy Director, VSSC and Project Director of Hypersonic Wind Tunnels Project. He has designed, built and commissioned the state of the art one meter hypersonic wind tunnel and one meter combustion driver shock tunnel. He has contributed to PSLV C25-Mars mission thermal and trajectory design, GSLV and LVM3 trajectory design. He has published more than 30 technical papers in leading journals and international and national conferences.

#### **ABSTRACT**

Aerodynamics and aerothermal aspects are integral parts of any launch vehicle which are accounted in the configuration design. In order to improve the design margins in terms of control system, performance and structural loads, the designers demand very accurate data from aero dynamists and aero thermal designers. In the advent of growth of computational fluid dynamics and accurate wind tunnel tests, data from these two sources are synthesized and final conclusions are arrived at. This paper brings out the various aerodynamic characteristics/ data requirements for various conditions of the missions viz.,the launch vehicle on the launch pad, lift off from launch pad, ascent data during subsonic, transonic and supersonic flow regimes, in terms of overall data, pressure and load distribution and acoustics. Similarly various aero thermal aspects like base heating due to jets, aerodynamic heating and associated issues are discussed.