Paper ID: 62112
interactive

55th IAA HISTORY OF ASTRONAUTICS SYMPOSIUM (E4)
Memoirs & Organisational Histories (1)

Author: Mrs. Iryna Fedorenko
The National Aerospace Educational Centre of Youth, Ukraine

ON THE CONTRIBUTION OF SCIENTISTS OF "YUZHNOYE" DESIGN OFFICE IN THE DEVELOPMENT OF ENGINEERING METHODS FOR CALCULATION OF HEAT AND MASS TRANSFER

Abstract

Heat is one of the most mysterious natural phenomena. The essence of it engrossed the minds of the prominent scientists and thinkers (philosophers) for centuries, since the understanding of this natural phenomenon determines the view of the Universe as a whole. It's been a long time before the agreed understanding of thermodynamic processes, on the basis of fundamental works of the scientists, was formed in the scientific world. This understanding resulted from the ideological battle between the supporters of the caloric theory and molecular kinetic theory. Their confrontation ended with the establishment of three fundamental principles (laws) of thermodynamics.

Discovery of these laws allowed creating the specific engineering methods for calculation of heat and mass transfer in the structures. However, complexity of thermal processes does not make it possible to find the universally applicable approaches to calculation of any structures, since they dictate their own conditions, and the designer should create his own methods based on understanding of the depth of thermal processes arising from the laws of thermodynamics. In this regard, rocket and space technology is a special subject for research in the field of thermodynamics. It can be explained by the novelty of problems, unusual designs and operating conditions of the objects. All this determined the tasks of the Thermal calculation division of "Yuzhnoye" Design Office from the initial stage of creating new models of the rocket and space equipment until today. When we analyze the results of more than 50 years of activity of the thermal engineers of "Yuzhnoye" DO, it can be said that in the entire history there have been no cases of abnormal functioning of the objects because of incorrectly specified thermal modes of operation of the rocket and spacecraft units.

Scientific and technical contribution of specialists of "Yuzhnoye" DO into research in the field of heat and mass transfer can be summarized as follows: 1.Creation of the methods for heat and mass transfer calculation on arbitrary shape bodies, taking into account high-temperature effects along the flight path. 2.Investigation of heat transfer and wear of mass of thermal protection coatings on the heads of LRBM (long-range ballistic missiles). 3.Creation of engineering methods for calculating the heating and breakage of thermal protection materials of heads and heat-stressed units of large-sized SPRE (solid propellant rocket engines). 4.For the first time in rocket and space technology, a solution to the problem of heat and mass transfer and combustion loss of the thermal protection material on the orbital head and the lunar block is provided (Unit , project -1). 5.Solving of the problem of heat balance for the artificial Earth satellite, depending on the time spent in the shadow of the Earth, based on the determination of the current and integral illumination by the Sun of the satellite surfaces oriented to the Earth. 6.Creation of the methodology for ensuring proper temperature and humidity conditions during long-term storage of fueled missiles in subsurface launch structures. 7.Development of theoretical foundations of the probabilistic methods for investigating the thermal regimes of rockets and head units.

All these works represent the worthy contribution of specialists of the State Enterprise "Yuzhnoye" Design Office" in the engineering methods of heat and mass transfer in the rocket and space technology.