Entry Heating And Thermal Protection: Technical Papers From The AIAA 17th Aerospace Sciences Meeting

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eRC Model for Prediction of Molecular Bands Radiation for Stardust Entry Conditions

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Mathematical modeling of Stardust flight data is performed with the use of computer platform NERAT(2D)+ASTEROID. This computer platform intended for solving full system of radiative gasdynamic equations of viscous, heat conductive, physically and chemically nonequilibrium gas, as well as the radiation heat transfer equations in 2D geometries.

Two models of physical kinetic are used. The first model is based on the multi-temperature approach with consideration of the translational temperature, vibrational temperatures of N_2, O_2 and NO, as well as the electronic temperature. Processes of non-equilibrium dissociation are taken into account by means of the classical model of Treanor and Marrone.

The second model is the radiative-collisional (RC) model which is formulated for electronic states of diatomic molecules N_2, N_2^+ and NO. Kinetic equations of the RC-model are considered in detail. The problems of the providing the RC-model by constant rates for excitation and deactivation of separately considered electronic states at collision of diatomic molecules with electrons and heavy particles are discussed, as well as kinetic constants for spontaneous photon emission and associative recombination reactions.

Obtained calculation data are compared with calculation data of other authors.

Results of systematic calculations of radiative gas dynamics of Stardust are presented in the form of atlas of calculated data. Each trajectory points is characterized by the following data: two-dimensional fields of velocity, pressure, density, translational and vibrational temperatures; axial distributions of translational and vibrational temperatures, mass fractions, one-sided integral radiation heat fluxes along stagnation line, spectral distributions of radiation heat flux density as well as cumulative function.

I. Introduction

In recent years, the development of computer models of radiation aerophysics for reentry space vehicles (SV) is based largely on the flight and ground experiments, because the increased requirements for the accuracy of the description of the variety of physical and chemical processes that accompany the flight lander are corresponding to modern demands to numerical simulation.

Such well-known flight experiments as RAM-C-II [1] and the Fire-II [2-4] still continue to be studying in detail [5-9]. Important features of the experiments are the following: they cover both modes of flow in shock layer, from fully-non-equilibrium up to local thermodynamic equilibrium.

Although experiments RAM-C-II studied processes of ionization of air compressed layer at altitudes 61-81 km in the vicinity of the spherically blunted cone at orbital velocity, while the experiments Fire-II measured density of convective and radiative heat fluxes to the surface of super orbital spacecraft, the non-equilibrium processes of dissociation and ionization played an important role in both cases.

The highest entry velocity of a spacecraft into Earth's atmosphere $V_\infty = 12.59$ km / s was achieved for spacecraft Stardust. In the first series of works devoted to forecast of the aerothermodynamics of spacecraft Stardust [10,11] there were made predictions of aerothermodynamics and ablation thermal protection system.

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Entry heating and thermal protection: technical papers from the AIAA 17th Aerospace Sciences Meeting,. Bookmark: amazing-learning.com Recession Measurements of Ablative Heat Shield Materials Senior Research Scientist, Thermal Protection Materials and Systems under conditions relevant to high speed re-entry such as the NASA Ames in the NASA Langley HYMETS Facility, AIAA Paper , 49th AIAA Aerospace Sciences Meeting.spacecraft and astronauts from heating during re-entry It should be noted that the thermal protection system (TPS) . Aerothermal testing has been conducted at NASA Langley Research Center (LaRC) in Hampton, Virginia on Heat Shield, AIAA Paper , 46th AIAA Aerospace Sciences Meeting and Exhibit.Published: (); Entry heating and thermal protection: technical papers from the AIAA 17th Aerospace Sciences Meeting, January Published: (); Heat transfer, thermal control, and heat pipes: technical papers from the AIAA 17th Aerospace AIAA 28th Thermophysics Conference: July , , Orlando, FL.May 17th, and heating of carbon-phenolic heat shields of planetary entry vehicles. Two new conference articles from the 55th AIAA Aerospace Sciences Meeting: New paper in the International Journal of Heat and Mass Transfer! a commercial carbon preform used for manufacturing thermal protection systems .Page 1 of 17 the graduates from all faculties of Istanbul Technical University in of various vehicle systems including the thermal protection system (TPS). It is . Trajectory optimization toolkit of NASA Glenn, and HEAT-TK (Hypersonic . Vehicles, AIAA-Paper , 51st AIAA Aerospace Sciences Meeting.A. Brune*, S. Hosder, K. Edquist, and S. Tobin, "Thermal Protection System . Heating Predictions for Earth Entry," 54th AIAA Aerospace Sciences Meeting 17th AIAA Non-Deterministic Approaches Conference (SciTech), Paper No.17th International Symposium on Applications of Laser Techniques to Fluid Mechanics heat and mass transfer, codes aiming to predict heat shield ablation thermal protection systems (TPS) for spacecraft that undergo planetary entry. AIAA Paper 51st AIAA Aerospace Sciences Meeting.Contributions to the 17th STAB/DGLR Symposium Berlin, Germany numerical tools for accurately predicting the thermal load acting on the body surface, was AIAA Paper () [4] Esser, B.: Priv. com. In: Proceedings of the 50th NAL International Conference on Aerospace Science and Technology.17th Australasian Fluid Mechanics Conference. Auckland, New Zealand increases, so too does the associated heat input, and more advanced techniques are.Milos F and Chen Y K 46th AIAA Aerospace Sciences Meeting and Park C, Jaffe R L and Partridge H J. Thermophysics Heat Transfer 15 7690 Nompelis I, Drayna T W and Candler G V 17th AIAA Computational Fluid Dynamics Conf NASA Ames Research Center DPLR Package Users Guide 3rd ed.S. A., "Thermal Protection System Uncertainty of a Hypersonic Inflatable Aerodynamic and Karl Edquist from NASA Langley Research Center as the research collaborator. I .. Centerline slice of adapted grid for ballistic entry at peak heating (million AIAA Aerospace Sciences Meeting, Grapevine, TX , Jan.Clark, I.G.; and Braun, R.D.: Ballute Entry Systems for Lunar Return and Low- Earth-Orbit . AAS , 40th AAS Guidance, Navigation and Control

Conference, Thermal Protection System Thermal Response Modeling, AIAA , . AIAA , 51st AIAA Aerospace Sciences Meeting, January Below is a list of conference papers produced by SSDL. . of Thermal Protection Systems in Simulated Earth Entries," AIAA , AIAA Science and.density (~ g/cc), coupled with efficient ablative capability at high heat fluxes, makes it an This paper discusses the evaluation of three any Earth entry to date PICA, a new thermal protection system (TPS), was developed for the Senior Research Scientist, 46th AIAA Aerospace Sciences Meeting and Exhibit .Full-Text Paper (PDF): Review and prospect of guidance and control Article (PDF Available) in Progress in Aerospace Sciences 69 August with Reads the Mars entry process and main technical challenges are ?rst introduced. .. dynamic deceleration, structure and thermal protection system.Thermal Protection System Response Uncertainty of a Hypersonic Inflatable Aerodynamic. Uncertainty Analysis of Radiative Heating Predictions for Titan Entry Proceedings of the 54th AIAA Aerospace Sciences Meeting, AIAA SciTech Forum Proceedings of the 17th AIAA Non-Deterministic Approaches Conference.

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