Spacecraft Environment Interactions

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Modeling of Spacecraft Environment Interactions on SMART-1 John Wiley & Sons

A NATO Advanced Study Institute (ASI) on the Behavior of Systems in the Space Environment was held at the Atholl Palace Hotel, Pitlochry, Perthshire, Scotland, from July 7 through July 19, 1991. This publication is the Proceedings of the Institute. The NATO Advanced Study Institute

Program of the NATO Science Committee is a unique and valuable forum, under whose auspices almost one thousand international tutorial meetings have been held since the inception of the program in 1959. The ASI is intended to be primarily a high-level teaching activity at which a carefully defined subject is presented in a systematic and coherently structured program. The subject is treated in considerable depth by lecturers eminent; in their :(ield and of international standing. The subject is presented to other scientists who either will already have specialized in the field or possess an advanced general background. The ASI is aimed at approximately the post-doctoral level. This ASI emphasized the basic physics of the space environment and the engineering aspects of the environment's interactions with spacecraft.

Spacecraft Interactions with the Space Environment CRC Press Introductory graduate textbook in spacecraft design and how space environment affects operations in space, for space scientists and engineers.

Handbook of Space Engineering, Archaeology, and Heritage Springer Science & Business Media

Nascap-2k is a three-dimensional computer code that models interactions between spacecraft and plasma environments in low-Earth, auroral, geosynchronous, and interplanetary orbits.

Previously, we reported on the accuracy of Nascap-2k's charging and current collections calculations by comparing computed currents and potentials with analytic results, and by comparing Nascap-2k results with published calculations using the earlier lower resolution codes, NASCAP/GEO, NASCAP/LEO, and POLAR. Here we examine the accuracy and limitations of two new capabilities of Nascap-2k: modeling of plasma plumes such as generated by electric thrusters and enhanced PIC computational capabilities. Nascap-2k models one or more ion engine plumes in full three-dimensional geometry, including plume-plume plume-spacecraft interactions. The primary thruster beam, parameters describing the neutral efflux, and the initial charge-exchange plume are imported from a Plume Tool generated file. Nascap-2k generates and tracks charge-exchange ions to obtain plasma densities and calculates potentials consistent with plasma densities and object surfaces. Nascap-2k's PIC capability has been expanded to include boundary injection, particle splitting, and substep charge deposition. We use calculations for simple geometries to explore the accuracy and limitations of these capabilities.

Spacecraft Environmental Interactions Technology, 1983

Springer Science & Business Media

The proceedings

published in this book document and foster the goals of the 11th International Space Conference on “Protection of Materials and Structures from Space Environment” ICPMSE-11 to facilitate exchanges between members of the various engineering and science disciplines involved in the development of space materials. Contributions cover aspects of interaction with space environment of LEO, GEO, Deep Space, Planetary environments, ground-based qualification and in-flight experiments, as well as lessons learned from operational vehicles that are closely interrelated to disciplines of atmospheric sciences, solar-terrestrial interactions and space life sciences.

Spacecraft/Environment Interactions CAE Tool. Volume 1. Users Manual

Princeton University Press

Natural space and atmospheric environments pose a difficult challenge for designers of technological systems in space. The deleterious effects of environment interactions with the systems include degradation of materials, thermal changes, contamination, excitation, spacecraft glow, charging, radiation damage, and induced background interference. Design accommodations must be realistic with minimum impact on performance while maintaining a balance between cost and risk. The goal of applied research in space environments and effects is to limit environmental impacts at low cost relative to spacecraft cost

and to infuse enabling and commercial off-the-shelf technologies into space programs. The need to perform applied research to understand the space environment in a practical sense and to develop methods to mitigate these environment effects is frequently underestimated by space agencies and industry. Applied science research in this area is critical because the complexity of spacecraft systems is increasing, and they are exposed simultaneously to a multitude of space environments.

Proceedings of the Spacecraft Charging Technology Conference Held in Monterey, California on 31 October - 3 November 1989 John Wiley & Sons

This publication presents the proceedings of ICPMSE-6, the sixth international conference on Protection of Materials and Structures from Space Environment, held in Toronto May 1-3, 2002. The ICPMSE series of meetings became an important part of the LEO space community since it was started in 1991. Since then, the meeting has grown steadily, attracting a large number of engineers, researchers, managers, and scientists from industrial companies, scientific institutions and government agencies in Canada, U. S. A. , Asia, and Europe, thus becoming a true international event. This year’s meeting is gaining even stronger importance with the resumption of the ISS and other space projects in LEO, GEO and

Deep Space. To reflect on these activities, the topics in the program have been extended to include protection of materials in GEO and Deep Space. The combination of a broad selection of technical and scientific topics addressed by internationally known speakers with the charm of Toronto and the hospitality of the organizers brings participants back year after year. The conference was hosted and organized by Integrity Testing Laboratory Inc. (ITL), and held at the University of Toronto's Institute for Aerospace Studies (UTIAS). The meeting was sponsored by the Materials and Manufacturing Ontario (MMO) and the CRESTech, two Ontario Centres of Excellence; Air Force Office of Scientific Research (AFOSR/NL); MD Robotics; EMS Technologies; The Integrity Testing Laboratory (ITL); and the UTIAS.

Study of the Space Radiation Environment in Geo Spacecraft--environment InteractionsIntroductory graduate textbook in spacecraft design and how space environment affects operations in space, for space scientists and engineers.An Online Spacecraft Environment Interactions Information SystemSpacecraft Environment Interaction InvestigationThis report summarizes the results of the spacecraft environment interaction investigation. The objectives of this investigation were to characterize environmental interaction

technology and to determine the adequacy of present military standards and handbooks for future, large AF missions. The characterization of the technology status was accomplished by literature searches and key-expert questionnaires. The determination of military standard adequacy was accomplished by considering interactions with five concepts synthesized from those available in the MSSTP. Based on these concepts studies, critical interactions were identified. The available military documentation was searched for applicability. A recommended document development plan was prepared along with a discussion of technology gaps. Keywords: Spacecraft, space environmental-interactions, space structures, high-power space systems, Astronauts, military handbooks, standards.Modeling of Spacecraft Environment Interactions on SMART-1Взаимодеíйствие космических аппаратов с окружающеíй средоíйроссиíйская конференция : Иркутск, 1-3 ноября 1995 г. : программа и тезисы докладовSpacecraft/environment Interactions CAE Tool User's ManualSpacecraft/Environment Interactions CAE Tool. Volume 1. Users ManualThis Computer Aided Engineering tool package will aid spacecraft developers by adding a user-friendly

interface to two spacecraft charging analysis codes, namely NASCAP/GEO NASA Charging Analyzer Program, Geosynchronous Orbits and POLAR 1.1 Potentials of Large Orbiting Spacecraft in the Auroral Region. The software package contains four major, independent programs. They are a model definition program with a specialized interface to ANVIL 5000, separate interactive control programs for analyzing models in different environments using either NASCAP/GEO or POLAR 1.1 and a graphics display program to present the calculation results using MOVIE. BYU DYNA-MOVIE. (kr).Spacecraft/Environment Interactions CAE Tool. Volume 2. Appendix C. User's ManualThis CAE tool package will aid spacecraft developers by adding a user-friendly interface to two spacecraft charging analysis codes, namely NASCAP/GEO NASA Charging Analyzer Program, Geosynchronous Orbits and POLAR 1.1 Potentials of Large Orbiting Spacecraft in the Auroral Region. The software package contains four major, independent programs. They are a model definition program with a specialized interface to ANVIL 5000, separate interactive control programs for analyzing models in different environments using either NASCAP/GEO or POLAR 1.1, and a graphics display program to present the calculation results using MOVIE. BYU DYNA-MOVIE. Keywords:

Computer aided design, Computer aided engineering. (SDW).Recent Observations of High Voltage Spacecraft Environment Interaction at LEO Altitudes Using Sounding RocketsSpacecraft Environmental Interactions Technology, 1983Spacecraft Charging TechnologyA summary of the problem of spacecraft charging by the ambient space plasma environment is presented. Some results of the Air Force/NASA spacecraft charging technology investigation are highlighted. Details of an Air Force/NASA spacecraft-environment interactions technology investigation are presented. This investigation will develop an environmental technology base for application to the development of next-generation large dimension, high power spacecraft. (Author).Spacecraft Interactions with the Space EnvironmentControl of Particle-spacecraft Interactions in a LEO Near-spacecraft EnvironmentNascap-2k Spacecraft-Plasma Environment Interactions Modeling: New Capabilities and VerificationNascap-2k is a three-dimensional computer code that models interactions between spacecraft and plasma environments in low-Earth, auroral, geosynchronous, and interplanetary orbits. Previously, we reported on the accuracy of Nascap-2k's charging and

current collections calculations by comparing computed currents and potentials with analytic results, and by comparing Nascap-2k results with published calculations using the earlier lower resolution codes, NASCAP/GEO, NASCAP/LEO, and POLAR. Here we examine the accuracy and limitations of two new capabilities of Nascap-2k: modeling of plasma plumes such as generated by electric thrusters and enhanced PIC computational capabilities. Nascap-2k models one or more ion engine plumes in full three-dimensional geometry, including plume-plume plume-spacecraft interactions. The primary thruster beam, parameters describing the neutral efflux, and the initial charge-exchange plume are imported from a Plume Tool generated file. Nascap-2k generates and tracks charge-exchange ions to obtain plasma densities and calculates potentials consistent with plasma densities and object surfaces. Nascap-2k's PIC capability has been expanded to include boundary injection, particle splitting, and substep charge deposition. We use calculations for simple geometries to explore the accuracy and limitations of these capabilities.The Behavior of Systems in the Space Environment Spacecraft--environment Interactions

Spacecraft Interactions with Hypervelocity Particulate Environment BiblioGov This CAE tool package will aid spacecraft developers

by adding a user-friendly interface to two spacecraft charging analysis codes, namely NASCAP/GEO NASA Charging Analyzer Program, Geosynchronous Orbits and POLAR 1.1 Potentials of Large Orbiting Spacecraft in the Auroral Region. The software package contains four major, independent programs. They are a model definition program with a specialized interface to ANVIL 5000, separate interactive control programs for analyzing models in different environments using either NASCAP/GEO or POLAR 1.1, and a graphics display program to present the calculation results using MOVIE. BYU DYNA-MOVIE. Keywords: Computer aided design, Computer aided engineering. (SDW).

The Space Environment

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A summary of the problem of spacecraft charging by the ambient space plasma environment is presented. Some results of the Air Force/NASA spacecraft charging technology investigation are highlighted. Details of an Air Force/NASA spacecraft-environment interactions technology investigation are presented. This investigation will develop an environmental technology base for application to the development of next-generation large dimension, high power spacecraft. (Author).

Protection of Materials and Structures from Space Environment

Springer
Spacecraft Power Technologies is the first comprehensive text devoted to the technologies critical to the development of spacecraft electrical power systems. The science and engineering of solar, chemical, and nuclear systems are fully examined together with the constraints imposed by the space and thermal environments in which the systems must operate. Details of present technology and the history that led to the current state-of-the-art are presented at a level appropriate for the student as a textbook or the practicing engineer as a reference.
Spacecraft Optical Environment World Scientific
The Spacecraft Charging Technology Conference was held at the Naval Postgraduate School, Monterey, California, from 31 October to 3 November 1989. This was the fifth in a series of meetings jointly sponsored by the Air Force and NASA to deal with spacecraft environment interactions. The meeting was attended by 108 people with 60 talks presented. The majority of the speakers have chosen to present their work in these two volumes. volume I contains pages 1 through 333, Volume II contains pages 334 through 624 ...
Spacecraft, Spacecraft charging, Space environment space plasma, Interactions.
The Space Environment and Its Effects on Space Systems Princeton

University Press
This Computer Aided Engineering tool package will aid spacecraft developers by adding a user-friendly interface to two spacecraft charging analysis codes, namely NASCAP/GEO NASA Charging Analyzer Program, Geosynchronous Orbits and POLAR 1.1 Potentials of Large Orbiting Spacecraft in the Auroral Region. The software package contains four major, independent programs. They are a model definition program with a specialized interface to ANVIL 5000, separate interactive control programs for analyzing models in different environments using either NASCAP/GEO or POLAR 1.1 and a graphics display program to present the calculation results using MOVIE. BYU DYNA-MOVIE. (kr).

Space and Atmospheric Environments

A summary of the present volume is presented in which the separate disciplines are drawn together to give an overview of the spacecraft environment during the GIOTTO-Halley interaction. Specific recommendations are made as to how the work of the Plasma Environment Working Group might continue to contribute to the GIOTTO program during encounter and post-encounter data analysis. 28 references, 3 tables.

From Low Earth Orbits to Deep Space

As commercial and military spacecraft become more important to the world's economy and defense, and as new

scientific and exploratory missions are launched into space, the need for a single comprehensive resource on spacecraft charging becomes increasingly critical. Fundamentals of Spacecraft Charging is the first and only textbook to bring together all the necessary concepts and equations for a complete understanding of the subject. Written by one of the field's leading authorities, this essential reference enables readers to fully grasp the newest ideas and underlying physical mechanisms related to the electrostatic charging of spacecraft in the space environment. Assuming that readers may have little or no background in this area, this complete textbook covers all aspects of the field. The coverage is detailed and thorough, and topics range from secondary and backscattered electrons, spacecraft charging in Maxwellian plasmas, effective mitigation techniques, and potential wells and barriers to operational anomalies, meteors, and neutral gas release. Significant equations are derived from first principles, and abundant examples, exercises, figures, illustrations, and tables are furnished to facilitate comprehension. Fundamentals of Spacecraft Charging is the definitive reference on the physics of spacecraft charging and is suitable for advanced undergraduates, graduate-level students, and professional space researchers.

Technology for Large

Space Systems
The Spacecraft Charging Technology Conference was held at the Naval Postgraduate School, Monterey, California, from 31 October to 3 November 1989. This was the fifth in a series of meetings jointly sponsored by the Air Force and NASA to deal with spacecraft environment interactions. The Meeting was attended by 108 people with 60 talks presented. The majority of the speakers have chosen to present their work in these two volumes. Volume 1 contains pages 1 through 333, Volume 2 contains pages 334 through 624 ... Spacecraft, Spacecraft charging, Space environment, Space plasma, Interactions.
The definitive guide to the modern body of spacecraft charging knowledge, this book authoritatively blends the theoretical and practical aspects of spacecraft charging. It defines the environment that can have significant effects on spacecraft, such as disruption of science measurements and solar arrays from electrostatic discharge (ESD). Combining the authors' extensive experience in spacecraft charging and in their provision of design support to NASA, JPL, and the commercial satellite market, this incredible book offers practical advice for neophytes in the field as well as experienced plasma physicists and spacecraft engineers.

Solar Activity and Effects on Spacecraft

The third Spacecraft Charging Technology

Conference, sponsored by the National Aeronautics and Space Administration and the U.S. Air Force, was held at the Air Force Academy from November 12 to 14, 1980. The proceedings contains 66 papers, dealing with the geosynchronous plasma environment, spacecraft modeling, charged-particle environment interactions with spacecraft, spacecraft materials characterization, and satellite design and testing. The proceedings is a compilation of the state of the art of spacecraft charging and environmental interaction phenomena. (Author).

ICPMSE-6

Examines how solar and terrestrial space phenomena affect sophisticated technological systems Contemporary society relies on sophisticated technologies to manage electricity distribution, communication networks, transportation safety, and myriad other systems. The successful design and operation of both ground-based and space-based systems must consider solar and terrestrial space phenomena and processes. Space Weather Effects and Applications describes the effects of space weather on various present-day technologies and explores how improved instrumentation to measure Earth's space environment can be used to more accurately forecast changes and disruptions. Volume highlights include: Damage and disruption to orbiting satellite equipment by solar particles and cosmic rays

Effects of space radiation on aircraft at high altitudes and latitudes Response of radio and radar-based systems to solar bursts Disturbances to the propagation of radio waves caused by space weather How geomagnetic field changes impact ground-based systems such as pipelines Impacts of human exposure to the space radiation environment The American Geophysical Union promotes discovery in Earth and space science for the benefit of humanity. Its publications disseminate scientific knowledge and provide resources for researchers, students, and professionals.

Spacecraft Environments Interactions

Examination Thesis from the year 2009 in the subject Physics - Electrodynamics, The University of Surrey, course: Electronic Engineering, language: English, abstract: The Space radiation environment in GEO has always been a severe challenge to the spacecraft industry. The Spacecraft Environment interaction has been the topic of deep investigation since 1970s to onwards. Very harsh space environment affects the spacecraft in various ways. The current project presents an overview of the characteristics of space radiation environment, its effects on spacecraft electronics and spacecraft operations. The elements of the space radiation environment such as Galactic Cosmic Rays (GCRs), Solar flare

protons and trapped electron belt in GEO are explained comprehensively. The effects of hazardous space radiation environment on a GEO spacecraft including spacecraft charging, Total Ionizing Dose (TID), internal charging and Single Event Effects (SEE) are introduced with necessary details. The space radiation environment models currently available are critically analysed and explained in the light of the work of different space researchers. The limitations and risks involved with these models are briefly introduced. The spacecraft design mitigation techniques and design guidelines are presented to help the spacecraft community build the spacecraft capable of surviving in hazardous radiation environment. Then some case studies of GEO satellite anomalies are also briefly explained. The ESA based Space Environment Information System (SPENVIS) software package is utilized for analyzing the temporal, spatial and diurnal variations of radiation environment in geostationary orbit and the simulation results are compared with GOES data. A detailed space radiation environment analysis for a Pakistani geostationary communication satellite Paksat-1R has been undertaken including the trapped electron flux estimation, solar proton flux estimation, Solar cell degradation and cover glass require

Spacecraft Interactions with Space Plasmas

The main objective is to conduct data analyses of SEPAC data and computer modeling to investigate spacecraft environment effects associated with injection of electron beam, plasma clouds, and neutral gas clouds from the Shuttle Orbiter. To understand the dependence of spacecraft charging potential on beam density and other plasma parameters, a two dimensional electrostatic particle code was used to simulate the injection of electron beams from an infinite conductor into a plasma. The ionization effects on spacecraft charging are examined by including interactions of electrons with neutral gases. A survey of the simulation results is presented and discussed. Lin, C. S. Unspecified Center...