

SPACE DEBRIS SYMPOSIUM (A6)
Modelling and Risk Analysis (2)

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MODELLING AND ESTIMATION OF THE PHOBOS-GRUNT PARAMETERS OF MOTION AND
RE-ENTRY

Abstract

One of the most significant problems created by space debris is an uncontrollable re-entry of so-called risk space objects (SO). Such SOs can cause the ecological, economic hazard and, even leads to death of people. For the support of taking the necessary well-timed measures for the counteraction to the hazards created by a re-entering risk SO, it is necessary to fulfill the permanent monitoring of such SO' flights. At the final stage of a risk SO orbital flight, before to its re-entry, it is necessary to apply a special ballistic, navigation and information maintenance including the intensive trajectory tracking and regular prediction of the re-entry parameters. One of the problems, connected with the control of a re-entered SO, is insufficient accuracy of the re-entry time prediction. This common problem is caused, in particular, by insufficiency of knowledge of aerodynamic characteristics of the space objects as well as incomplete adequacy of the used atmospheric models to the real environment condition. Importance and difficulty of the solution of a problem of SO' uncontrollable re-entry prediction have been once again shown in a case when the space craft Phobos-Grunt re-entered. Maintenance of this space vehicle re-entry fulfilled both the Russian space organizations and other countries participating in a special international test campaign, organized by the Inter-Agency Space Debris Coordination Committee (IADC). In this paper the results of the Phobos-Grunt orbit determination (OD) and re-entry prediction obtained during its flight are resulted. For determination of the most probable time and impact area of the Phobos-Grunt re-entry the special post-flight analysis has been fulfilled. This analysis was based on the considerable quantity of the different variants of SC' orbit determination at using of different types of data representing various tracking sensors. In addition the different dynamical models of the Earth atmosphere in OD were applied: American Jacchia (1970), Russian GOST-25645.115-84 (edition 1990), American NRL MSISE-00 (2000), Russian GOST-25645.166-2004. Two of them: GOST-2004 and NRL MSISE-00 had been recognized as the most adequate in term of the measurements fitting. As a result of the posterior analysis the accuracy of the SC re-entry at operative ballistic and information maintenance was estimated. Final results of the determination of the Phobos-Grunt re-entry as well as the results of other participants of the IADC test campaign 2012 allowing to compare them to each other are represented.