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NACRAC: NEW ALGORITHM FOR COLLISION RISK ASSESSMENT AND CLASSIFICATION:
INSURANCE AND LEGISLATIVE ASPECTS

Abstract

The number of orbiting objects is constantly growing, and with it the need to define quick and efficient methods to estimate probability and effects of space collisions. Among the variables that must be considered to assess the collision risk of a spacecraft, the characteristics of the satellite itself, the orbit of reference and the end-of-life management are of paramount importance. Combining geometric characteristics of a satellite under review, such as the exposed surface, with orbital characteristics, e.g. the population of orbiting objects, a probability spectrum can be obtained. This must be then linked to severity and thus to direct mitigation strategies such as collision avoidance or indirect mitigation strategies such as PMD (Post Mission Decommissioning).

Risk tables definition could be an effective way to provide an immediate and reasonably accurate description of the problem. A hierarchic-based subdivision and classification of satellites, if accepted by the space community, would allow an easy definition of the insurance premium related to a given mission and could lead to new regulations to better control issues related to the increasing number of space launches. NACRAC, or New Algorithm for Collision Risk Assessment and Classification, is proposed as a solution to this problem by labelling new satellites, simplifying the job of insurers and space lawyers in estimating damages, their probability and related liabilities. NACRAC extends individual risk assessment into a collective context, highlighting risks that undermine the protection of the orbit under consideration. By applying existing methodologies and answering to market needs, this algorithm proposes an innovative risk classification using a unique identification code.

NACRAC could be the basis for a new model international guideline on satellite activities, including an insurance obligation for space activities. The combination of the insurance obligation and the risk assessment provided by NACRAC would be a critical factor in the regularisation of space activities. Moreover, NACRAC will be able to facilitate a more effective analysis of the risks connected with a given satellite activity; in the event of a collision between satellites or between satellites and space debris, it would thus be easier to reconstruct the legal aspect of fault, which is essential for the attribution of liability for damage caused in space (Article III Liability Convention).

The paper will address the technical aspects of this algorithm, as well as the calculation methods and the insurance and legislative aspects. NACRAC's possible applications and their repercussions will then be highlighted.