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AN INNOVATIVE METHOD FOR THE DEFLECTION OF POTENTIALLY HAZARDOUS ASTEROIDS

Abstract

An impact of an asteroid with the Earth can have catastrophic consequences and therefore it is very important to put effort in the analysis of possible methods for avoiding or minimizing the effects of such an event. Different possibilities are under study for the deflection of potentially hazardous objects, in order to divert them from a trajectory that can lead to a collision with the Earth. In this paper the possibility of utilizing a space tug for the deviation of an asteroid is discussed. The idea is to exploit as much as possible a space tug initially designed for different applications, like servicing of satellites or on-orbit spacecraft assembly. In particular the major differences and improvements to be introduced in the space tug design for accomplishing the asteroid deflection are discussed. Different possibilities for the deflection system are identified and evaluated, relying for example on a laser beam or using a tether to capture the object to move it from its original trajectory. Dedicated trade-offs lead to the selection of the most suitable configuration, which is then analysed in depth. In particular the selected deflection system is described in terms of major requirements and mission implementation. The paper starts with the definition of the reference mission for the deflection of a potentially hazardous object, specifically focusing on the requirements assessment and mission analysis. The concept of operations and the main architecture elements are presented, as well. The second part of the paper deals with the thorough description of the finally selected NEA deflection system, with particular attention to the space tug features. For what concerns this last point, particular attention is given to the description of the design improvements needed to adapt the space tug initially used for satellites orbit transfer to the NEA deflection mission.