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FIRESHIP: AN INTELLIGENT NETWORK OF FIRST RESPONDER INSITU PROBES TO MITIGATE HAZARDOUS ASTEROIDS

Abstract

Addressing an urgent need for a reliable mitigation operation to disrupt or deflect an approaching potential hazardous object (PHO) such as an asteroid, we propose a intelligent and self-organized network of the in-situ probes called FIREShIPs. This ground-breaking architecture uses a distributed network of in-situ probes designed to act collaboratively to 1) map the PHO's topography and internal structure using the probes' ground penetrating radar and other science instruments; 2) use those data to calculate the fundamental characteristics and optimal pressure points of the PHO; and 3) reposition the probes at those pressure points on the surface of the PHO to either fragment the PHO to benign pieces (using explosive charges onboard the probes), or use the thruster-equipped probes as an optimal set of multi-vector thrusters to finely tune and control the PHOs trajectory and movement, in order to displace or redirect it to a safe trajectory or location. FIREShIPs architecture is comprised of a mother-spacecraft traveling to the target PHO while carrying a number of light and inflatable in-situ probes equipped with thrusters and/or explosive devices. The mother-spacecraft could first perform a brief remote examination to detect the possible optimal pressure points, and to deploy the FIREShIPs to those areas. The FIREShIPs are equipped with various science instruments (including a GPRS) in order to scan and determine the surface and the internal structure and specifications of the asteroid (e.g. size, mass, the existence and location of larger metal or rocky chunks, the discrete number of pressure points, etc.). The spherical mobile FIREShIPs (aka Moballs) are also equipped with their novel and finely tuned hexa-axel magnetic impulse-based motion control system in order to reliably move on micro gravity bodies and reorganize themselves to optimize the grasping or smashing operations. Furthermore, they are able to pierce into or latch onto the surface of the asteroids or comets, using their novel heating and tubes or pads. The peer-to-peer communication between the deployed FIREShIPs as well as with their mother-spacecraft, will create a distributed and intelligent networking system capable of coordinating the "grasp and steer away" or the "smashing" of the PHO. The FIREShIP asteroid or comet mitigation-operation system introduced here, will provide an unprecedented and extremely resilient and reliable PHO mitigation operation system capable of adapting itself with different types of PHOs and situations.