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☒ **Deflection and Disruption Models & Testing**

**GUIDED ASTEROIDS AGAINST HAZARDOUS ASTEROIDS: INNOVATIONS
FROM RUSSIA**

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ABSTRACT

The problem of protecting the Earth against dangerous asteroids is well known. Work on the creation of planetary defense systems is underway in many countries. Russian Prime Minister Dmitry Rogozin (now General Director of the Roscosmos State Corporation) has offered other countries cooperation in the field of protection against asteroids, since neither Russia nor other countries have the means to destroy asteroids that are dangerous to the planet, and urged the leading states of the world to pay attention to this important problem.

This paper develops the idea of using guided projectile-asteroids to deflect dangerous asteroids (<https://doi.org/10.1134/S0010952510050175>) based on the concept of distributed integrated navigation systems which elements are located on projectile-asteroids, target-asteroids, and on the Earth (<https://doi.org/10.1134/S2075108716030093>).

For the purposes of creating international cooperation for the reliable planet protection, the paper presents: 1) Opportunities of the Center for Operation of Space Ground Based Infrastructure regarding launching payloads from Russian cosmodromes (<http://en.russian.space>); 2) Possibilities of the Kuznetsov Research Institute for Applied Mechanics (RIAM) regarding the development, manufacture and supply of inertial command devices (<http://en.russian.space/250/>) for placement in open space on asteroids. The RIAM is the leading enterprise in Russia for creating precise command tools for rockets and spacecrafts. Its command tools allowed the launch of the first satellite of the Earth, provided Yuri Gagarin's flight, docking of the

USSR and US spacecraft in space as part of the Soyuz-Apollo program, circling and photographing the far side of the Moon, delivering lunar soil to Earth. The RIAM has developed high-precision gyroscopes, accelerometers, gyrostabilized platforms and strapdown inertial systems for ballistic missiles, launch vehicles (Vostok, Voskhod, Molniya, Soyuz, Progress, Energiya), for returned manned spacecraft, satellites (Spectrum, Araks, Sesat, Express, Glonass, Yamal, Monitor-E, Kazsat, Resurs-DK, etc.), and orbital stations (Salyut, Almaz, Mir, International Space Station), as well as for the Moon, Mars, Venus and the Halley's Comet exploration spacecraft control systems. Devices developed at the RIAM have high accuracy and reliability: up to 150,000 hours of continuous operation and more than 25 years of lifetime (<http://www.russian.space/250/>).

The paper discusses the following innovations: the criteria for selecting projectile-asteroids; the use of distributed integrated navigation systems; the strategy of 2D-targeting projectile-asteroids on target-asteroids which allows solving the problem of deflecting dangerous asteroids using existing modern space facilities. Also presented are structural diagrams of a complex of planetary protection against asteroids (<https://www.researchgate.net/publication/310797755>).