Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

Handout

Asteroid Finder

Fig. 1 shows a structural calculation model of the Asteroid Finder satellite

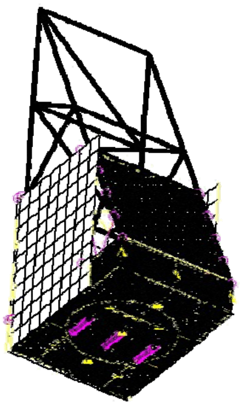
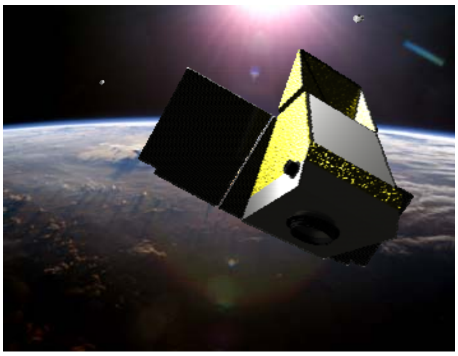


Fig. 2 Artificial image of the satellite in Orbit



The Mission
By now, more than 500,000 Asteroids are known in the solar system. Telescopes scan the night sky looking for moving light dots in order discover the asteroids. Knowing about their existents and their orbit is of great interest for science. It allows to learn more about the formation of the solar system, to test simulating models and to predict and ultimately prevent an asteroids impact on the earth.
Even though most of the Asteroids have been discovered during the last two decades, only 10 objects are known that stay within the earths orbit around the sun at all times. Their number is not greater because from the earth's ground no Asteroid can be seen against the day's bright sky. To find an Asteroid closer to the centre of our Solar system one must leave the lower atmosphere.

After launch in 2014, the DLR-Satellite "Asteroid Finder" will repeatedly take images of the sky close to the sun. Moving objects can be identified by comparing images of the same sky section taken at different times. Whether or not objects are found, the results will greatly help to calibrate simulation models of the asteroid distribution in the solar system while at the same time increase our safety on earth.

Satellite Requirements
Though in orbit the problem of the glaring sky is solved, the image taking equipment (telescope and computers) must be of high quality to find the small and dark Asteroids. This leads to several demands on the satellite structure. First it has to carry and protect the fragile instruments at high loads during launch. Then it has conduct heat from the power consuming image processing computers to the outer surfaces, where the heat is radiated into space. Finally it has to shield the optics from direct sun light, hence it needs a huge cover. At the same time the satellite and mainly its structure has to be light and agile to be able to slew in a short time and take pictures from many different sections of the sky.

Challenges in the Structural Design
A quick slewing, which in this case means 10° in less than a minute, requires a low moment of inertia meaning low masses combined with a high concentration of the masses close to the centre of gravity. This is solved by combining all electronic equipment in an aluminium box directly beneath the telescope. Although it is heavy, the aluminium is necessary to conduct heat to the outer surfaces of the satellite.
The telescope is surrounded by a framework of very light carbon fibre struts that support an enveloped of insulating kapton foil layers. This protects the telescope's structure from the sun's heat as well as the optic's from direct sun and stray light. Furthermore the frame work carries the solar panels and communication antennas.
The concentration of the masses, the sophisticated framework and the use of high modulus fibre composites keep the satellites light and agile while at the same time stiff and rigid enough to withstand the launch accelerations and vibrations.

The Project passed the preliminary design review in November 2011 but was stopped in January 2012 due to excessive cost increase by an external supplier.

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