German Aerospace Center

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100 years ago: The asteroid explosion in Tunguska

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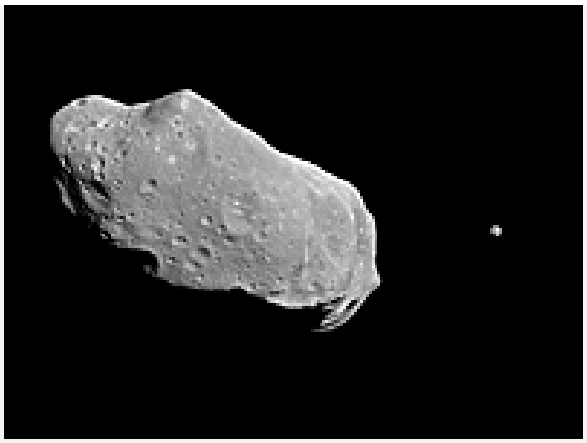
More than 20 000 square kilometres of devastation

DLR investigates defensive measures as part of international cooperation

100 years ago, on 30 June 1908, an asteroid exploded in a remote area of Siberia, having hit the atmosphere at a speed of possibly seventy thousand kilometres per hour. Such impacts from space are rare, but they pose a very real threat to Earth. The German Aerospace Center (DLR) is taking part in international cooperative measures in helping to protect us from small, potentially dangerous objects in the Solar System.

The asteroid which collided with Earth 100 years ago had a diameter of about 30 to 50 metres. It exploded some eight to twelve kilometres above the Tunguska river and produced a ground-facing pressure wave, with the explosive power of several hundred Hiroshima atomic bombs. For more than 2000 square kilometres around the epicentre, 60 to 80 million trees were flattened. The Tunguska event devastated an area twice the size of Berlin.

"It has been long known that small bodies from both the inner and outer Solar System pose a potential regional or perhaps even global threat to the planet.", remarked Dr Ekkehard Kührt, who leads the Small Bodies department at the DLR Institute for Planetary Research. "While there is currently no immediate risk, the basic scientific work and planning to take defensive measures is a growing area. These days we can possibly develop the means to avert the danger, if we have enough warning."



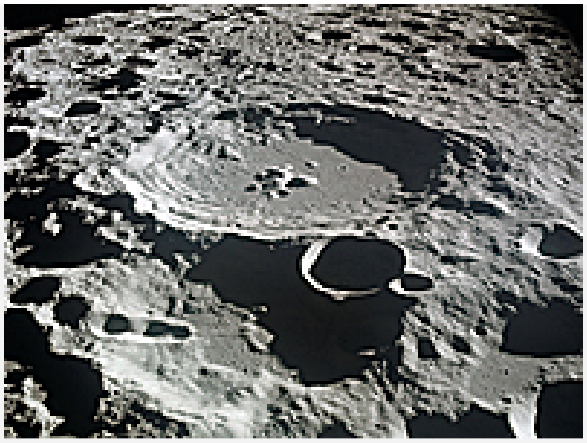
Asteroids – remnants of planet formation

Of particular interest are those asteroids and comets whose orbits around the Sun come close to Earth's orbit and are therefore considered to be "Near-Earth Objects" (NEOs). NEOs are intensively monitored and international cooperation is underway in both estimating the dangers to Earth from space and how to take defensive measures. The DLR Institute for Planetary Research reports German research activities at regular intervals to the United Nations Committee for the Peaceful Use of Outer Space (COPUOS).

Asteroids and comets represent a threat to the world

Impacts of asteroids and comets with Earth, other planets and their moons have been normal since the beginning of the Solar System four and a half billion years ago. The many craters visible on Mercury, the Moon and Mars are a testament to this. Millions of tiny dust particles hit and burn up in Earth's atmosphere daily. They can be seen sometimes from the ground as 'shooting stars'.

Very rarely does an object impact Earth's surface and leave a crater. This happened 15 million years ago when a kilometre-sized object landed in the Swabian Jura and created a crater, now world famous as the 'Nördlinger Ries'. Even the evolution of humans is due an asteroid hit - 65 million years ago a mega-impact wiped out the dinosaurs and helped the rise of mammals. Such huge impacts, which devastate whole continents, cause global climate disasters and change the biosystem occur in the history of Earth only every several hundred million years.



Cosmic collisions - a normal occurance in the Solar System

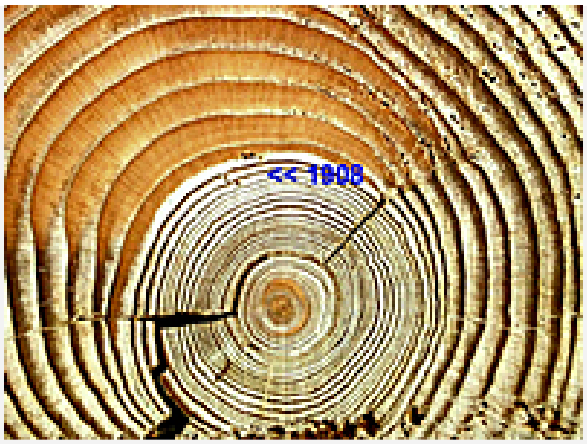
An event of the scale of the Siberian impact of 1908, according to theoretical models, occurs every few centuries. A similar event today involving populated areas would cause disastrous consequences - with hundreds of thousands of casualties expected. Should an explosion or impact occur at sea, tsunamis could inundate the coastlines of entire continents, devastating cities. The economic consequences of global crises would follow.

Measures that could be taken

"Basically, there are two ways to prevent the impact of a small body," said Dr Christian Gritzner from DLR's Space Agency in Bonn. "You can either try to destroy the object, or steer it away on a less dangerous course."

In his dissertation at DLR, Dr Ralph Kahle proposed that given a warning of at least ten years, one or more probes could be aimed at the incoming object, using enough force to steer the object off-course.

In 2007, the NASA ran simulations of nuclear explosions using models. This scenario could see us using enough momentum to drive the object away from impacting, but there are two risks. First, could this sort of nuclear material be safely launched? Also, a body whose internal cohesion is low (as in the case of many comets) could lead to the object fragmenting into smaller pieces, some of which could penetrate the atmosphere with unpredictable consequences.



Witnesses to the Tunguska event

Searching for cosmic missiles

DLR decided only recently to develop a small satellite to orbit with a small asteroid-detecting telescope onboard - trying to find those objects which could pass near to Earth's orbital path. "Model calculations suggest that there are more than a thousand objects with diameters larger than a hundred metres inside Earth's orbit," says Ekkehard Kührt.

Since only nine of these Inner-Earth Objects (IEOs) have been found, it is important that these potential sources of danger are identified - preferably before gravitational interference by Venus could change their courses and set them on a collision course with Earth. The detection and monitoring of IEOs from the ground proves particularly difficult since such objects (as well as the planets Venus and Mercury) lie between Earth and the Sun and are only visible just before sunrise or just after sunset.

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