CASE STUDY

CAREN
global collaboration

Protecting the Earth from hazardous asteroids

High-speed research networks facilitate international scientific collaboration to monitor asteroids that threaten us

One day in 2013, shortly after dawn broke over the Russian city of Chelyabinsk, a violent explosion in the air above the town caused a flash as bright as the sun, a shockwave that injured more than a thousand people and extensive damage to property. A single large meteoroid had entered the Earth's atmosphere, where it exploded with a force of around 30 times that of the Hiroshima bomb.

Protecting against such hazards begins with monitoring them to calculate their precise orbits; this requires fast, reliable internet connections – such as that provided by the Central Asia Research and Education Network (CAREN) – so the huge volumes of observation data can be sent speedily and reliably to scientists around the world for analysis.

Understanding the threat

The Chelyabinsk meteoroid was one of around 14,000 known 'near-Earth asteroids', of which some 1,700 are classified as 'potentially hazardous asteroids' (PHA). In other words, objects that represent a real danger to the entire biosphere and all human activity. This meteoroid's diameter was 17 metres; we know of at least one PHA – called Adonis – due to make a close approach to Earth in 2029 that is about twenty times bigger.

Powerful telescopes operated by the Institute of Astrophysics of the Academy of Sciences of the Republic of Tajikistan help us understand the threat in detail. To minimise the effects of light pollution, the telescopes need to be sited well away from population centres; they are located in Tajikistan's mountainous regions – one in Gissar, and one in Sanglokh, near Danghara. However, the necessary remoteness of these locations creates a problem: transferring the huge volume of observation data generated by the telescopes to the Institute's facility in Dushanbe, where researchers are engaged on an international programme to identify PHAs whose trajectories threaten us.

The challenge: to contribute to the worldwide efforts to track and understand the potentially cataclysmic threat to the planet of hazardous asteroids.

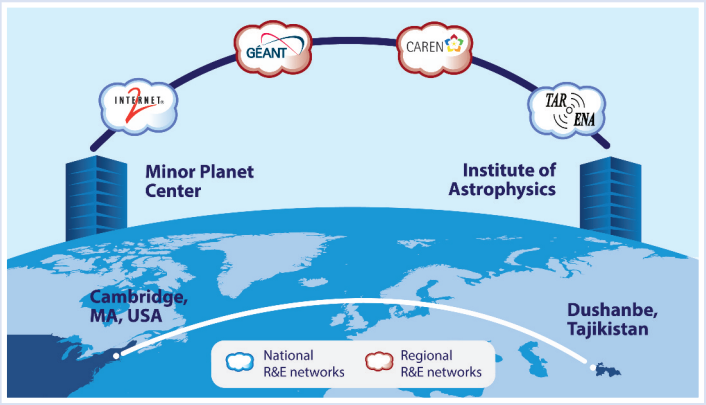
The solution: to provide access for research institutes across the world to the data collected by telescopes in Tajikistan, using the CAREN, GÉANT and Internet2 networks.

Key benefits: data from the Tajik observatories adds to information processed and held by the International Astronomical Union's Minor Planet Centre in the USA – the worldwide focus for monitoring the threat from 1,700 potentially hazardous asteroids.

Fast connections, speedy response

At present the telescope data is transferred manually on disks and USB sticks to the Institute, recently connected via fibre optics to TARENA, the Tajik national research and education network. TARENA, in turn, is connected at gigabit speed to the

GÉANT TARENA INTERNET2



The data route between the Astrophysics Institute in Tajikistan and the MPC in the USA, via dedicated national and regional research and education internet networks.

regional CAREN backbone, as well as to its European counterpart, GÉANT, and thus to the global research community.

These links enable the Institute to collaborate effectively with its international partners, and to transmit telescope data for further analysis to the International Astronomical Union's Minor Planet Centre (MPC) – located in Cambridge in the USA.

Work currently underway to also connect the telescopes to TARENA will complete the picture: a fast, seamless and reliable real-time link between telescopes in Central Asia and scientists in the USA.

"We transfer and receive large datasets to and from the MPC, which is the global focus for all information about the positions of the threats we monitor. The MPC is in the US and without CAREN's secure high-speed connectivity, we simply couldn't participate in the work of the centre. CAREN is in large part responsible for the international reputation and authority that our Institute now enjoys."

Dr Gulchehra Kokhirova
Director of the Institute of Astrophysics of the Academy of Sciences of the Republic of Tajikistan.

The MPC is a vital element

in the protection of the Earth from these threats. It identifies PHAs, computes their orbits, maintains a worldwide master database and keeps the research community abreast of important developments and discoveries via regular electronic circulars.

The effectiveness of the MPC as a global focus for this work relies on speedy worldwide co-operation – hugely enhanced by the capability provided by high-speed, high-quality research and education networks such as CAREN (Central Asia), GÉANT (Europe) and Internet2 (USA).

Svetlana Gerasimenko
A life with comets

The discovery of the Comet 67P – famously visited by the Rosetta spacecraft and Philae lander – typifies the kind of international co-operation enabled by CAREN. One of the discoverers of the comet was Svetlana Gerasimenko. Born in poverty-stricken Ukraine in 1945, she became a Soviet researcher in Kazakhstan, collaborated with many western colleagues and, in 1973, went on to have a glittering career at the Institute of Astrophysics in Dushanbe, where she still works.

CAREN: a modern Silk Road

For many centuries, the Silk Road was the long-distance route through which Asia and Europe traded and communicated. Today, CAREN is upgrading this ancient trade route to a high-speed internet highway, connecting researchers and educationalists throughout the region. Launched in 2009, CAREN – now in its third phase – currently interconnects R&E communities in Kyrgyzstan and Tajikistan, with plans to re-connect Kazakhstan and Turkmenistan. Uzbekistan is a candidate for future inclusion. Links to other continental networks, such as GÉANT, give CAREN worldwide reach, allowing seamless co-operation between scientists, academics and students in Central Asia and the rest of the world.

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For more information:
CAREN: https://caren.geant.org
GÉANT: www.geant.org
TARENA: www.tarena.tj

Internet2: www.internet2.edu
EU: https://ec.europa.eu/europeaid

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