



UTER SPACE

A huge fireball from space exploded above a Russian city, injuring more than a thousand people—and no one saw it coming.

Could it happen again?

By Justin O'Neill | Art by Gary Hanna



Synthesizing Together, these articles tell you about a problem Earth faces and possible solutions. Look for these as you read.



LOOK FOR WORD NERD'S 10 TERMS IN BOLD

As the sun rises on February 15, 2013, the people of Chelyabinsk, Russia, are starting their mornings. But the 1.1 million residents of this city are in for an unusual day. A space rock is headed straight for Chelyabinsk. It's 65 feet across—about as wide as your school gym. And nobody has any idea.

This rock has been circling close to Earth for thousands of years. This morning it enters our atmosphere (the layer of gases that surround Earth).

The rock gets hotter and hotter as it zooms toward Earth. It becomes so hot that it starts to crumble. It travels 40,000 miles an hour. Now it's about 15 miles above the ground. It won't be long until . . . it explodes!



Above and top left: The Chelyabinsk fireball was captured by many people using cell phones and cameras. Their images have greatly aided scientists. Bottom left: A meteorite crashed into a frozen lake, leaving a large hole.

The people of Chelyabinsk look up, puzzled. They see a fireball streak across the sky. They watch it disappear in a flash of light brighter than the sun. A strange trail of smoke is left behind. Some people run outside or to windows for a better look. Others pull

their cars over.

What was that? A missile? A plane crash? Aliens?!

Two minutes pass. Then—
BOOM! SMASH!

Bangs echo when invisible **shock waves** shake Chelyabinsk. Walls collapse. People fall. Windows break. Pieces of glass fly into homes, schools, and offices. About 1,500 people are hurt.

They are lucky. It could have been worse.

Rocks From the Sky

Do you ever look at the night sky and see a shooting star? It's beautiful—but don't let the name confuse you. A shooting star is not really a star. It's a meteor. A meteor

is the stream of light created when a rock burns up in Earth's atmosphere. Our **solar system** has millions of rocks: asteroids (large space rocks), comets (part rock and part ice), and meteoroids (smaller space rocks). Very large, bright meteors are called fireballs. The space rock in Chelyabinsk was a fireball. Any pieces that land on Earth are called meteorites.

People from long ago wrote about **sacred** rocks from the sky. The Egyptians called meteorites "metal from the sky." They turned them into special jewelry and knives. The Greeks and Romans believed that space rocks were messages from the gods. The ancient Chinese recorded meteor showers.

In 1794, a German physicist suggested that meteorites come from outer space. But no one took him seriously. At that time, people believed rocks from the sky came from

Earth. They thought the rocks were first swept

up by strong winds then dropped back to the ground. Then, in 1803, thousands of meteorites fell on a French town. A physicist named Jean-Baptiste Biot went to see. Biot's research convinced scientists that rocks do fall from space.

Now we know that space rocks are leftovers from long ago. They're from about 4.5 billion years ago when the planets of our solar system formed. The rocks move around the sun in circles called **orbits**, like the planets do. Generally, they stay in the asteroid belt, an area between Mars and Jupiter. But sometimes the rocks knock into each other and bounce around like bumper cars. Then they stray close to Earth. Each day, Earth is hit by 100 tons of space **debris** [duh-BREE]. Most of this space debris burns up in the atmosphere without causing any harm.

But if an asteroid larger than a mile across hit Earth, it would be a **catastrophe**.

Sixty-six million years ago, an asteroid probably led to the dinosaurs' extinction. That asteroid was 6 miles wide. Scientists believe dust clouds from the explosion



JIM MICHAEL/MAPMAN® (MAP); ANDREI ROMANOV/STRINGER/REUTERS/NEWS.COM (METEORITE)

This photograph of a flattened forest shows the destruction caused by the Tunguska event. Fortunately, no one lived in Tunguska. If the explosion had occurred above Paris or London, the city would likely no longer exist.



blocked out the sun. The sun may have been blocked out for months. This caused plants and animals to die.

Could that happen again?

Another Close Call

The last time a meteoroid caused as much damage as the one in Chelyabinsk did was more than 100 years ago. That meteoroid also fell in Russia.

In 1908, a farmer named S.B. Semenov was on the porch of a **trading post** in a big area in Russia. Suddenly, the sky lit up. A shock wave knocked him to the ground. He felt strong heat. Semenov later wrote, “It almost burned the shirt off me.”

Semenov was more than 40 miles away from the center of what is called the Tunguska event. Tunguska is in the remote Russian wilderness. The explosion had the force of nearly 200 atomic bombs. It knocked down 80 million trees.

Because Tunguska is so remote, it took decades to understand what happened. The mystery inspired odd theories: a UFO explosion, a science experiment gone wrong, a black hole passing through the planet.

In fact, what happened in Tunguska was just like what happened in Chelyabinsk. But the Tunguska meteor was much larger and closer to the ground. These events are very

rare. Few of today’s scientists imagined they would live to see anything like it. Very large asteroid events, like the one that probably doomed the dinosaurs, are even more rare. They happen only once every 100 million years or so.

We’re Not Alone

What happened in Chelyabinsk is a reminder: We live on a planet that is drifting through space. And we’re not alone. Drifting along with us are objects that may someday be a threat. But scientists around the world are working **feverishly** to make sure that such an event never happens again.

Luckily, no one in Chelyabinsk was killed. Most injuries were minor. Many people in the area have a new hobby: hunting for meteorites. Even small pieces of the fireball can be worth thousands of dollars.

But if you were to see a meteorite, you probably wouldn’t think it was special. Most look like boring black rocks.

You’d probably walk right by it. ■

Planet Protectors

How scientists are keeping Earth safe from future asteroid disasters

Sooner or later, a space rock like the one in Chelyabinsk will come **hurtling** toward Earth. But scientists are working to be ready when it happens.

America's space agency, NASA, uses telescopes to scan the sky for asteroids, meteoroids, and comets. NASA works with other space agencies around the world. And they have already found 95 percent of the very largest asteroids. Scientists are building stronger telescopes that will be able to see smaller space rocks.

The first step to protecting the planet: finding space rocks. The next step is figuring out where they're going.

The B612 Foundation is an organization that hopes to help with that. B612 is making a digital map of the asteroids that are close to Earth. The map will track their movements.

It will also predict whether they are headed our way.

Looking Both Ways

But if we knew that a large asteroid was coming toward us, could we do anything about it? The experts at B612 say yes. Scientists have explored many different ideas: from shooting the asteroid with lasers to blasting it apart with a bomb. Most agree that the best plan would be to redirect it away from Earth. We would do this by crashing an **unpiloted** spacecraft into the asteroid. If we couldn't do that, we might have time to evacuate a city before an explosion.

B612 says there's no reason to panic. Asteroids are just part of the universe. We can't change that. But we have the technology to prepare for future impacts.

"We do lots of things to protect ourselves," says Diane Murphy, a spokeswoman for B612. "Just like we look both ways for cars when we cross the street, we need to look both ways for asteroids." ■



Former astronaut Edward Lu helped found B612.

MAKE A CONNECTION

Write an exchange of letters between two friends. One is concerned about the problem presented in the first article; the other tries to reassure the friend with information from the second article. Each letter should include details from the texts.

FIND
A SKILL
BUILDER
ONLINE!