THE ATMOSPHERICRESERVOIR
Examining the Atmosphere and Atmospheric Resource Management

AN ATMOSPHERIC FIREBALL

By Mark D. Schneider

During the early morning hours of June 2, an asteroid approached the Earth's upper atmosphere at a speed of roughly 40,000 miles per hour. Fortunately, this object was only estimated to be 10 feet in diameter and broke up as it descended towards southern Arizona. According to *Space.com*, "Earth gets hit by about 100 tons of space material (mainly dust and sand-sized particles) every day."

It's believed that many small pieces of this asteroid reached the Earth's surface north of Tucson, Arizona as meteorites. The National Weather Service's Doppler Weather Radar detected the scattering of debris as the event occurred. Many people remember the Chelyabinsk, Russia event of February 2013 when an asteroid estimated to be about 65 feet in diameter caused a brilliant fireball 30 times brighter than the sun as it entered the Earth's atmosphere. The sonic boom created from this meteor shattered windows and damaged thousands of buildings.

The terms *asteroid*, *meteor*, and *meteorite* are often used interchangeably, but they have different definitions. Fortunately, the American Meteor Society (not to be confused with the American Meteorological Society) has clear, concise definitions of each:

Asteroid – small, rocky, iron or icy debris flying in space (from 1 meter to hundreds of kilometers).

Fireball – a meteor brighter than the planet Venus.

Meteoroid – a small asteroid (from microns to 1 meter).

Meteor – the light emitted from a meteoroid or an asteroid as it enters the atmosphere.

Meteorite – a fragment of a meteoroid or an asteroid that survives passage through the atmosphere and hits the ground.

NASA's website explains that about once every year, a small asteroid becomes a fireball entering the Earth's atmosphere and burning up before impact. Every 2,000 years or so, a football field-sized asteroid collides with Earth and causes significant damage. What can be done to predict such an occurrence? The orbits of asteroids are determined by matching elliptical paths around the sun with each asteroid's location. This has to be performed several times before accuracy is reached. A prediction or forecast is made for a particular asteroid's position in the sky and is then compared to the actual position once it makes an orbit and is again visible to us. If the prediction is inaccurate, a correction is made and a new comparison will likely show improvement on the asteroid's actual position.

If a discovery was ever made that a large asteroid could impact Earth, the primary method for prevention would be to change its orbit. This sounds like a formidable task; however, we would have time on our side. There would likely be many years of lead-time between the initial discovery and any potential impact. During this time, a small space probe could be sent to intercept the asteroid and steer it off course. It would take minimal force by the probe to alter this orbit. NASA has already begun developing the technology to accomplish this and its current Asteroid Redirect Mission (ARM) should be launching a robotic spacecraft towards a large asteroid by 2020. The spacecraft plans to use a robotic arm to capture a boulder off of the asteroid and then redirect it to a stable orbit around the moon. Even more promising are plans to launch astronauts into space to study the asteroid in the mid 2020s once this orbit around the moon is established.

Sometimes when it seems like the sky is falling, we just need to look at the bigger picture in order to make sense of everything.

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