The Center for Really Fast Approaching Objects

CRFAO: CLASSIFIED

DATED: TODAY

CRFAO BRIEFING: "OPERATION BIG ROCK"

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HERE'S THE DEAL . . .

Background Information: What are Asteroids?

Asteroids are rocky and metallic objects that orbit the Sun just like planets. The picture on the right, taken in 2000 by NASA's Near spacecraft, is of Eros, an asteroid that is 20 miles long by 8 miles wide. Eros is called the "fat banana" because of its shape. One theory suggests that Eros and all asteroids are the remains of a planet that was destroyed in a massive collision long ago. More likely, asteroids are material that never joined into a planet during the formation of the solar system. If the estimated total mass of all known asteroids was gathered into a single object, the object would be 1,500 kilometers (932 miles) across which is less than half the diameter of the Earth's Moon. Asteroids range in size from Ceres, the largest asteroid, which has a diameter of about 1000 km (620 miles), down to the size of boulders. There are sixteen known asteroids that have a diameter of 240 km (155 miles) or greater. Asteroids have been found from inside Earth's orbit to beyond Saturn's orbit, but most are contained within a main belt that exists between the orbits of Mars and Jupiter. Some have orbits that cross Earth's path and some have even hit the Earth in times past. Technically speaking, when an asteroid enters the earth's atmosphere and collides with Earth, it is called a meteorite.

"Fat Banana" an Asteroid in space.

Web LINKS for More Information on ASTROIDS:

- www.barringercrater.com
- www.solarviews.com/eng/asteroids.htm.
- http://neo.jpl.nasa.gov
- http://impact.arc.nasa.gov
- http://neo.planetary.org
- http://asteroid.lowell.edu/asteroid
- http://www.spaceguarduk.com

EDITORIAL COMMENTS: BY MS. I.C. STARRS

CRFAO: *Ms. Starrs, do you have any advice for our Engineering Design Team that will help them accomplish this incredible assignment?!*

I.C.: "Well, let's see... I certainly never would have expected to see a natural disaster of this sort during my lifetime!! I am confident, however, if the student design team uses common sense, and basic math and science skills, they will be successful in designing underground caverns to house the residents of Alabraska. My advice: Use your Noggin!! (your brain, that is). You can do it if you work together."

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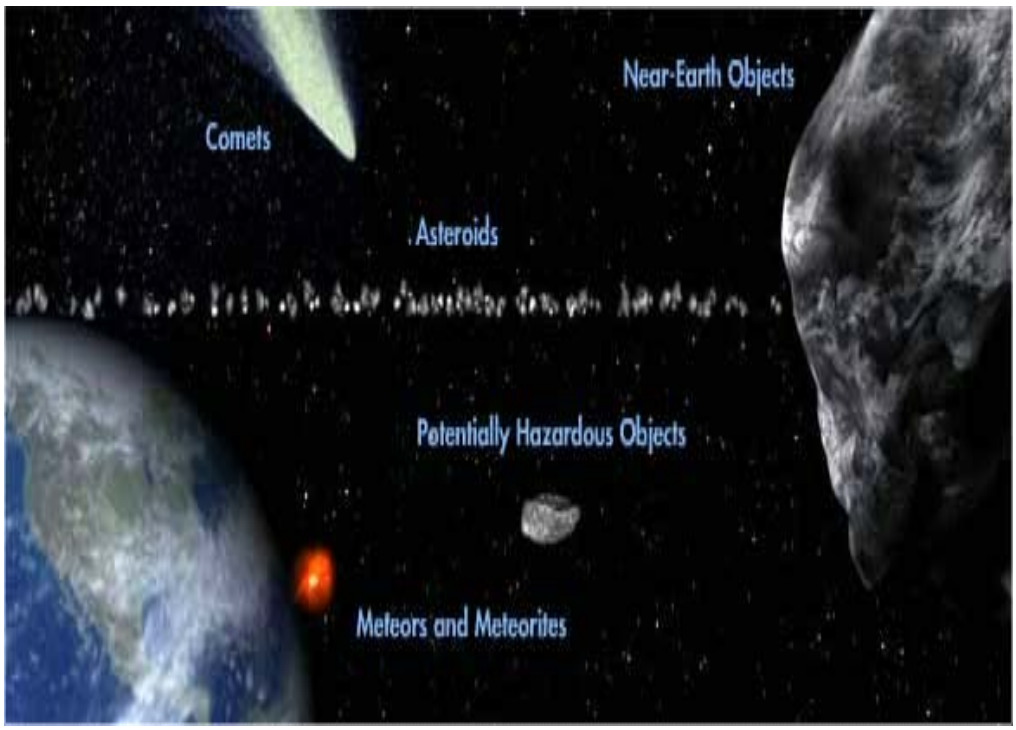
BIG ASTROIDS LEAVE BIG CRATERS!

Notice the crater left by the Barringer meteorite in Arizona when it impacted Earth (picture 1). The diameter of the crater is one-mile, similar to the one in your project. You can learn all about the Barringer crater at www.barringercrater.com and all about asteroids at www.solarviews.com/eng/asteroids.htm.

The Barringer Crater in Arizona— look at the size of it!

NEAR EARTH OBJECTS !!!



ARTISTS CONCEPT OR NEO (NEAR EARTH OBJECTS : FROM NASA'S JPL WEB SITE (www.jpl.nasa.gov)

"The state of Alabraska is counting on you!"

— Homer DeBrave
President of The U.S.A.

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Other Sources of Information on "Near Earth Objects"

Excerpts from the web page of NASA's Near-Earth Object Program Office

"NASA's Near-Earth Object Program Office was established in mid-1998 to help coordinate, and provide a focal point for, the study of those comets and asteroids that can approach the Earth's orbit. The Earth's mean orbital distance from the sun is defined as an astronomical unit (1 AU) or approximately 93 million miles. Near-Earth Objects (NEOs) are generally defined as those objects whose close approaches to the sun are 1.3 AU or less. As a result, Near-Earth Objects are those comets and asteroids that can come within about 28 million miles of the Earth's orbit.

The intent of this web page is to bring together relevant information on all aspects of Near-Earth Object studies and, in particular, to explain why these objects are so important to life on Earth. These objects have struck the Earth in the past and they will do so in the future. It has only been relatively recently that the role of NEOs on the formation of the early Earth and Earth's life forms has been realized. Small Near-Earth Objects collide with the Earth on a daily basis. Fortunately, as the size of a NEO increases, there are fewer of them so that a collision with a truly large NEO is a very unlikely event. Nevertheless, there is a growing scientific consensus that numerous

ARTISTS' CONCEPT OF ASTROID IMPACT source: NASA JPL Website

NASA's "Near-Earth Object" Information Continues. . . .

collisions of comets and asteroids with the early Earth first frustrated the development of life and then, as the bombardment lessened, these same collisions delivered to the Earth the veneer of carbon-based materials and water that allowed life to form. Subsequent, intermittent strikes by large comets and asteroid then punctuated the development of life, allowing only the most adaptable species to develop further. For example, a large comet or asteroid collided with the Earth 65 million years ago thus eliminating about 75% of the Earth's life forms including the large reptiles (dinosaurs). With the demise of these dominant creatures, the smaller but more adaptable mammals could develop further. As a result, we humans may owe our very existence to comet and asteroid impacts with the Earth. Although comets and asteroids are among the smallest of the solar systems bodies, in terms of life on Earth, their importance is in no way proportional to their size. Next to the sun itself, theirs is the most important realm."

Written by Don Yeomans from NASA's NEO Office Program. Go to www.neo.jpl.nasa.gov.

" You can do it — if you work together"

— I.C. Starrs

Director of the Center for Really Fast Approaching Objects

".. we humans may owe our very existence to comet and asteroid impacts with the Earth"

–Don Yeomans
NASA, NEO Office

Why don't more Asteroid's hit the earth?

to Earth and are large enough in size to warrant close observation. That's because the gravitational tug of the planets could, over time, cause an object's orbital path to evolve into an Earth-crossing orbit. This allows for the possibility of a future collision.

ASTROID "IDA" - NASA

How big is a dangerous asteroid?

A relatively small number of near-Earth objects pass close enough

Potentially hazardous asteroids are about 150 meters (almost 500 feet) or larger, roughly twice as big as the Statue of Liberty is tall. They approach Earth to within 7.5 million kilometers (about 4.6 million miles). By comparison, when Mars and Earth are at their closest, they are about 53 million kilometers (about 33 million miles) apart.

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REVIEW: Asteroids are rocky fragments left over from the formation of the solar system about 4.6 billion years ago. Most asteroids orbit the Sun in a belt between Mars and Jupiter. Scientists think there are probably millions of asteroids, ranging widely in size from hundreds of kilometers across to less than one kilometer (a little more than one-half mile) wide.

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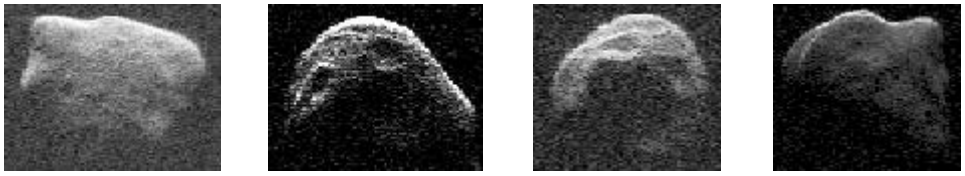
"'We've got our eye on the sky!"

"The risk of dying as a result of an asteroid impact is about 1 in 20,000, the same risk you face of dying in a plane crash".

- Source: Spaceguard Survey



One Asteroid's Story . . .

With an average diameter of about 3.5 kilometers (2 miles), 1999 JM8 is the largest of the so-called potentially hazardous asteroids ever studied in detail. Although this object can pass fairly close to Earth in celestial terms, astronomers concur that an actual encounter with Earth is not of concern in the next few centuries.

The new images, obtained with NASA's Goldstone Solar System Radar in California and the Arecibo Observatory in Puerto Rico, reveal that 1999 JM8 is a several-kilometer-wide object with a peculiar shape and an unusually slow and possibly complex spin state, said Dr. Lance Benner of NASA's Jet Propulsion Laboratory, Pasadena, CA, who led the team of astronomers. The images are available online at http://photojournal.jpl.nasa.gov or http://echo.jpl.nasa.gov/~lance/1999JM8.html.

"It will take much more data analysis to determine the object's shape and exact rotation state," Benner said. "But just from looking at the images we can see that this nearby world is extremely peculiar. At this point we do not understand what some of the features in the images are, much less how they originated."

Dr. Steven Ostro of NASA's JPL, has led dozens of asteroid radar experiments. Radar studies have revealed a stunning array of exotically shaped worlds with compositions ranging from solid metal to low-density carbonaceous rock and rotation periods ranging from 11 minutes to more than a week. "These are very, very strange places," he said. "I really envy the coming generations of space explorers who will visit them."

The asteroid 1999 JM8 (4 photographs above) was discovered on May 13, 1999

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