

# NEW HORIZONS IN SPACE

by Seymour Simon

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Many science fiction stories that I read when I was younger told of going to the moon, exploring Mars, and discovering thousands of planets circling distant stars in the Milky Way galaxy. These stories have become real, science fact not science fiction. Now, a new frontier in space is opening—mining for minerals on asteroids. This may soon become the latest science fiction to become true science nonfiction—and it may provide resources that we Earth people desperately need. 1

Mining for minerals in space is the process of finding and collecting minerals and other raw materials from asteroids, planetary moons, and other space objects near Earth. Working in space is very expensive and much of the equipment still has to be developed and designed, so it's not likely that this will happen right away. However, in November 2015, the United States Congress passed and the president approved a bill making mining legal in space. There are private companies working on this already. 2

But mineral reserves on Earth are limited and people are consuming them faster and faster. Based on known reserves and how fast we are using them in modern industry and food production, scientists estimate that many essential minerals could be exhausted on Earth in 50–60 years. These include important metals such as gold and silver (rare and expensive), platinum and palladium (precious metals used in electronics), tungsten, iron, nickel, copper, and aluminum (used to make cars and planes and many other things). 3

## What Can We Do When We Run Out of These Crucial Substances?

Space mining is one possible solution to the problem. Some of these important minerals may be mined on asteroids and sent back to Earth for use in manufacturing and food production. The 4

minerals can also be used on the same asteroid where they are found to build solar-powered stations and satellites. Water from the ice on some of the asteroids can be processed into hydrogen and oxygen for rocket fuel and for humans to breathe.

Earth and the many thousands of asteroids circling the sun in our solar system were all created from the same basic elements when the solar system was formed. This means that asteroids have many of the same materials that are present in Earth's crust. Most of the asteroids orbit around the sun in a region between Mars and Jupiter called the Asteroid Belt. Other bunches of asteroids, such as the Trojans and the Greeks, are found in groups near the orbit of Jupiter, the giant planet of our solar system. Near-Earth asteroids and some comets travel into the inner solar system and pass close to or cross over the orbit of Earth.

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## How Would We Get There? And How Would We Get Back?

Much of the rocket fuel needed to launch a spaceship is used just in takeoff from Earth. Fortunately, all of the asteroids have a much lower gravity than Earth and even the moon. So landing a spaceship on a low-gravity, near-Earth asteroid uses much less fuel than landing on the moon and is much easier than landing on Mars. This means that nearby asteroids are likely places for early mining trials.

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There are three main types of asteroids.

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- C-type asteroids have a lot of water (in the form of ice) as well as carbon and other minerals for fertilizers that can be used to grow food in space colonies for astronaut miners.
- S-type asteroids have little water but contain many valuable minerals. Scientists have estimated that even a small S-type asteroid, only 10 meters (about 11 yards) across, contains over a million pounds of different metals and over a hundred pounds of rare metals such as gold and platinum.
- M-type asteroids are rare but contain 10 times more metal than S-types.

In recent years, 12 asteroids out of 9,000 searched by a group of space scientists were identified as prospective sites that could be mined with present-day rocket and mining technology. Though rich with valuable resources, they are quite small, ranging in size from 2 to 20 meters (6.5 to 65.5 feet) in diameter. These asteroids could be propelled by rockets into a near-Earth orbit and then mined for essential elements. 8

Several companies are involved in space mining and asteroid research locating. One group, the B612 Foundation, is dedicated to protecting Earth from asteroid strikes. It conducts research to help detect asteroids that might strike Earth one day and to find the means to change their paths to avoid such collisions. Data gathered by this group could also be used to identify possible asteroids that could be used for collecting mineral resources. 9

Other private companies are making plans on how best to find and extract minerals from asteroids. In recent years NASA has mentioned that it is interested in studying whether it is possible to launch humans to land on asteroids. New spaceships would have to be developed that are different than the ones currently used to operate in Earth orbit or in the gravities of the moon and Mars. 10

One way or another, space mining might lower the cost and change the way we explore space. The abundance of water on some of the asteroids could be used to produce fuel to further explore more asteroids and return their mineral resources to help the people of Earth. The exciting science fiction magazines I read many years ago may become a gateway to new realities of science fact. 11

*Source:* Courtesy of Seymour Simon.