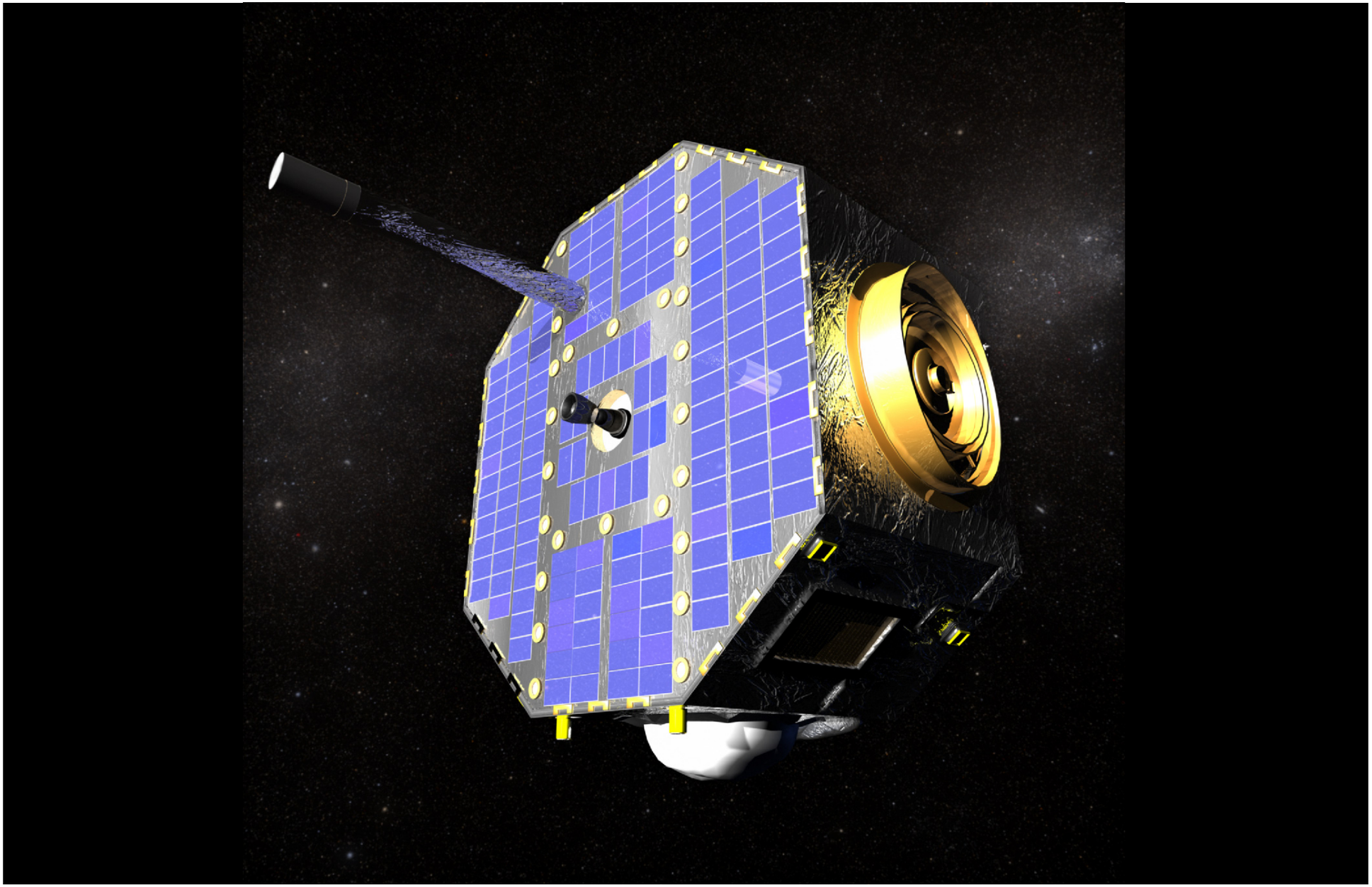
National Aeronautics and Space Administration



Interstellar Boundary Explorer (IBEX)

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Interstellar Boundary Explorer

Mission Overview

IBEX is a NASA-funded Small Explorer satellite mission that creates the first maps of the boundary of the Solar System from an orbit around Earth. The acronym IBEX stands for Interstellar Boundary Explorer.

The invisible boundary of our solar system is created by the interaction between particles from the Sun that are streaming outward, called the solar wind, and material between the stars, called the interstellar medium (ISM). The solar wind streams out into space and carves out a protective bubble, called the heliosphere, in the ISM around our Solar System. When the solar wind and ISM meet, their interactions make energetic neutral atoms (ENAs), which are particles with no charge that move very fast. Although ENAs leave the boundary in all directions, some travel back towards Earth and can be collected and measured by IBEX. Using information about the mass, location, and energy of the ENAs it collects, IBEX can make maps of the invisible boundary.

By analyzing the maps created from IBEX data, scientists can determine what the interaction of the solar wind and the interstellar medium is like everywhere on the surface of the heliospheric bubble. For example, scientists are trying to find out if there are some areas where the interstellar medium stops the solar wind abruptly or other places where a gradual stop of the solar wind may occur. Also, scientists are trying to determine the overall shape of the bubble.

IBEX uses a Pegasus rocket to launch into space. This is an inexpensive launch option, especially for smaller spacecraft.

IBEX is 23 inches high and 38 inches across. It has an octagonal shape like a stop sign. It is approximately the size of two bus tires stacked on top of one another, but it is much heavier, weighing almost 300 pounds (~1000 pounds with fuel.)

IBEX begins its ride during a launch from Kwajalein Atoll, Marshall Islands in the middle of the Pacific Ocean. An L-1011 airplane takes the Pegasus rocket and the attached IBEX spacecraft to a high altitude. Then, the Pegasus fires its own rockets to propel it and IBEX into space. The satellite has its own small rocket engine that will allow it to climb into an orbit that takes it 5/6 of the distance to the Moon, or around 200,000 miles (325,000 km) away. Even though this orbit is high, it is still very far from the Solar System boundary that it is measuring. The distance to the edge of the heliosphere is around 9 billion miles (14 billion km) from the Earth, or about 100 times the distance between the Earth and the Sun.

The IBEX mission is led by the Southwest Research Institute in San Antonio, TX. The mission is managed by the Explorers Program at the NASA Goddard Space Flight Center in Greenbelt, MD for the Science Mission Directorate at NASA Headquarters in Washington.

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IBEX was built in collaboration with Los Alamos National Laboratories, Lockheed Martin Advanced Technology Center, Orbital Sciences Corporation, Johns Hopkins University's Applied Physics Laboratory, the University of New Hampshire, Boston University, and the University of Bern in Switzerland. IBEX's Education and Public Outreach efforts are led by Adler Planetarium in Chicago, IL.

Educational Activity

How far is IBEX from the Earth? How far is the Moon from Earth?
Grab a ball – any ball will do! This will be the Earth. How far do you think the Moon is from the Earth? On this scale, how far would a model of the Moon be from your model of the Earth? Make some guesses, and ask others with you to guess, too.

The Moon's distance from Earth is equal to about 30 times the diameter of Earth. For example, the Earth's diameter is about 8,000 miles (12,000 km). 30 times this distance is about 240,000 miles (about 390,000 km). Measure your Earth ball model. Multiply this size by 30 to get the distance to the Moon on your scale model. How close were you?

IBEX orbits 5/6 of the distance from the Earth to the Moon, or 5/6 of the distance between your Earth and Moon models. 5/6 of 30 Earth diameters is 25, so IBEX travels 25 model Earth diameters (and back) approximately every 8 days. Use the tip of your finger to trace out one orbit of the IBEX spacecraft in your model. Note: Most of the time the orbit doesn't line up with the Earth and Moon.

Extensions: How big would the Moon be in your scale model?
The Moon is ¼ the size of the Earth, so find a ball that is ¼ the size of your Earth ball.

How far would the Sun be in your model?
About 390 times the distance between the Earth and Moon!

How far would the edge of the Heliosphere be in your model?
Approximately 100 times the distance to the Sun!

To learn more, play games, and sign up for monthly mission updates:
Visit *www.nasa.gov/ibex* or *http://ibex.swri.edu*