National Aeronautics and Space Administration

NASA**facts**

NASA's Interstellar Boundary Explorer Mission

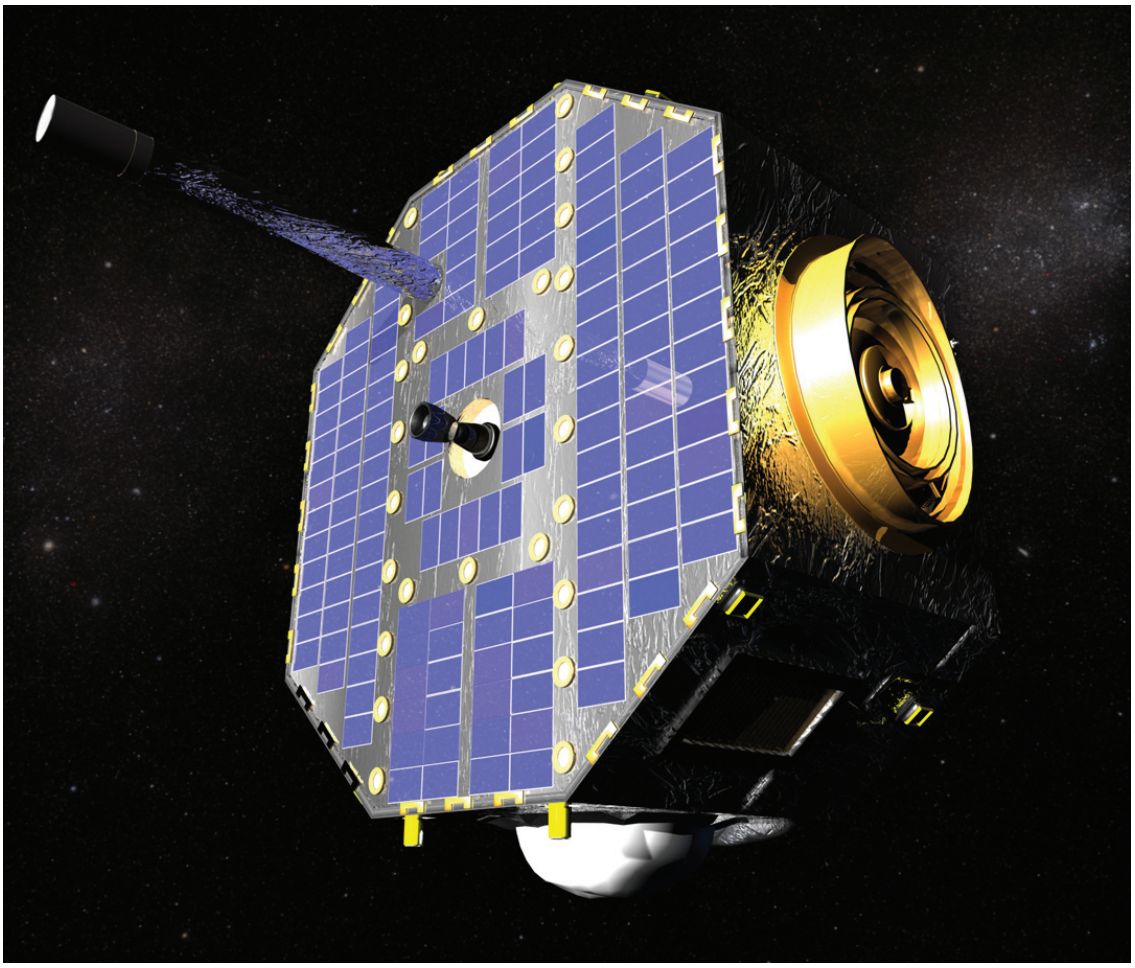
"Impressionist" Spacecraft to View Solar System's Invisible Frontier

At the edge of our solar system in December 2004, the *Voyager 1* spacecraft encountered something never before experienced during its then 26-year cruise through the solar system—an invisible shock formed as the solar wind piles up against the gas in interstellar space. This boundary, called the termination shock, marks the beginning of our solar system's final frontier, a vast expanse of turbulent gas and twisting magnetic fields.

A NASA-sponsored team is developing a way to view this chaotic, but unseen, realm for the first time. Just as an impressionist artist makes an image from countless tiny strokes of paint, NASA's new *Interstellar Boundary Explorer* (IBEX) spacecraft will build up an image of the termination shock and areas beyond by using hits from high-speed atoms that are radiating out of this region.

"IBEX will let us make the first global observations of the region beyond the termination shock at the very edges of our solar system. This region is critical because it shields out the vast majority of the deadly cosmic rays that would otherwise permeate the space around the Earth and other planets," says Dr. David J. McComas, IBEX Principal Investigator (PI) from the Southwest Research Institute (SwRI) in San Antonio, Texas. "IBEX will let us visualize our home in the galaxy for the first time and explore how it may have evolved over the history of the solar system. Ultimately, by making the first images of the interstellar boundaries neighboring our solar system, IBEX will provide a first step toward exploring the galactic frontier."

IBEX is scheduled to be launched on a Pegausus rocket in July 2008. It needs to go beyond the region of space controlled by Earth's magnetic



Credit: Walt Feimer

field, called the magnetosphere, because this region generates radiation and the same high-speed atoms (Energetic Neutral Atoms or ENAs) that IBEX will use to make its pictures. To avoid contamination from local ENAs produced in the magnetosphere, IBEX's orbit will take it up to 200,000 miles from Earth. Six months into the mission, IBEX will have observed the entire sky, and will reveal the global structure of the heliosheath and termination shock for the first time.

"The solar system's frontier is billions of miles away, so it's difficult for us to go there, but interesting things happen at boundaries, and with IBEX, we will see them for the first time," said Dr. Robert MacDowall, IBEX Mission Scientist at NASA's Goddard Space Flight Center in Greenbelt, Md.

The IBEX mission is funded by NASA's Small Explorer program. It is a PI-led mission being run by SwRI, which is responsible for all aspects of the mission. Orbital Science Corporation in Dulles, Virginia, is SwRI's subcontractor for the IBEX spacecraft and also provides the Pegasus launch. The Explorer Project Office at NASA Goddard oversees all Small Explorer missions, including IBEX.

Launch: July 2008. An L-1011 "Stargazer" aircraft will take the Pegasus launch vehicle to a high altitude and release it. The Pegasus rocket will carry IBEX into a low-Earth orbit (60 miles altitude). The IBEX spacecraft's own solid rocket motor will then propel it into a very high altitude orbit (with apogee ~200,000 miles).

Launch Vehicle: Pegasus XL. Launch will be from Kwajalein Island in the Marshall Islands, South Pacific. Launch from this site takes advantage of the energy of the Earth's rotation, which is greater near the equator than at higher latitudes.

Instrumentation: Two very large aperture single pixel "cameras" that measure energetic neutral atoms with energies of 10 eV to 2 keV (IBEX-Lo) and 300 eV to 6 keV (IBEX-Hi).

Spacecraft Weight: Spacecraft (empty) = 80 kg (176 lbs); spacecraft (with fuel) = 107 kg (236 lbs); payload = 26 kg (57 lbs); flight system (includes IBEX's solid rocket motor and associated hardware) = 462 kg (1016 lbs).

Spacecraft: Size = 23 inches high x 38 inches across (eight-sided shape, like a STOP sign).

Power: During nominal operations, the spacecraft uses 66 Watts; payload uses 16 Watts. The solar array produces 116 Watts.

Propulsion: The spacecraft is coupled with an ATK Star 27 solid rocket motor, which will boost it from its high-injection orbit to its high-altitude apogee. IBEX features a hydrazine propulsion system with significant excess capacity.

Communication: IBEX has two hemispherical antennas with a 3 dB coupler and diplexer that will provide virtually spherical coverage for uplink and downlink. Downlink data rate = 320 kbps (nominal); 2 kbps for the Tracking and Data Relay Satellite System (TDRSS). Uplink data rate = 2 kbps.

Ground Operations: Mission Control Center at Orbital Sciences Corp. in Dulles, Virginia; IBEX Science Operations Centers at Southwest Research Institute in San Antonio, Texas, and Boston University in Boston, Massachusetts. The mission will utilize Universal Space Networking ground stations.

Mission Duration: 24 months after turn on and initialization (nominal) with the possibility of mission extensions.

For more information about IBEX, visit:
http://www.nasa.gov/ibex

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