Juno slingshots past Earth on its way to Jupiter

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Juno, carrying a University of Iowa-designed-and-built instrument, will arrive at Jupiter in July 2016. Credit: NASA/JPL-Caltech

If you've ever whirled a ball attached to a string around your head and then let it go, you know the great speed that can be achieved through a slingshot maneuver.

Similarly, NASA's Juno spacecraft will be passing within some 350 miles of Earth's surface at 3:21p.m. EDT Wednesday, Oct. 9, before it

slingshots off into space on a historic exploration of Jupiter.

It's all part of a scientific investigation that began with an August 2011 launch. The mission will begin in earnest when Juno arrives at Jupiter in July 2016. Bill Kurth, University of Iowa research scientist and lead investigator for one of Juno's nine scientific instruments, the Waves instrument, says that the two years spent moving outward past the orbit of Mars before swinging past the Earth makes the trip to Jupiter possible.

"Juno will be really smoking as it passes Earth at a speed of about 25 miles per second relative to the sun. But it will need every bit of this speed to get to Jupiter for its July 4, 2016 capture into polar orbit about Jupiter," says Kurth, who has been involved with the mission since the beginning. "The first half of its journey has been simply to set up this gravity assist with Earth."

"One of Juno's activities during the Earth flyby will be to make a movie of the Earth-moon system that will be the first to show Earth spinning on its axis from a distance," says Scott Bolton, principal investigator for the Juno mission from Southwest Research Institute in San Antonio.

Kurth and colleagues UI Professor Don Gurnett and research scientist George Hospodarsky note that the real science will begin when Juno begins orbiting Jupiter some 33 times over the course of a year. Juno will be the first spacecraft to orbit Jupiter over its poles. The orbit will be highly eccentric, taking Juno from just above the cloud tops to a distance of about 1.75 million miles from Jupiter, every 11 days.

The UI-designed-and-built Waves instrument will examine a variety of phenomena within Jupiter's polar magnetosphere by measuring radio and plasma waves. It's one of nine experiments to be undertaken of the gas giant.

In particular, Juno will explore the solar system's most powerful auroras—Jupiter's northern and southern lights—by flying directly through the electrical current systems that generate them.

"Jupiter has the largest and most energetic magnetosphere, and to finally get an opportunity to study the nature of its auroras and the role radio and plasma waves play in their generation makes Juno a really exciting mission for me," says Kurth.

Juno's other major objectives are to understand the origin and evolution of the solar system's largest planet by:

- Determining the amount of water and ammonia present in the atmosphere.
- Observing the dynamics of Jupiter's upper atmosphere.
- Mapping the planet's magnetic and gravity fields to learn more about its deep interior including the size of its core.

Gurnett, a world leader in the field of space plasma physics, says the Juno spacecraft and its unique orbit will expand upon Jupiter data gathered by previous UI instruments.

Juno's destiny is a fiery entry into Jupiter's atmosphere at the end of its one-year science phase as a means of guaranteeing it doesn't impact Europa and possibly contaminate that icy world with microbes from Earth. This would jeopardize future missions to that moon designed to determine whether life had begun there on its own.

The Juno Waves instrument will be the eighth UI instrument to make the trek to Jupiter. Previous Iowa instruments were carried aboard Pioneers 10 and 11, Voyagers 1 and 2, Galileo (including two UI instruments), and Cassini, currently in orbit around Saturn.

The Waves instrument was built at the UI by a group of about a dozen scientists, engineers, and technicians, led by research engineer Donald Kirchner. Terry Averkamp, Chris Piker, and William Robinson assist in the operation of the Waves instrument and in the data processing.

The Juno project is a collaborative enterprise, led by Scott Bolton of the Southwest Research Institute of San Antonio, including the UI and many other organizations and individuals.

Provided by University of Iowa