

Dawn approaches asteroid Vesta

April 8 2011, by Dauna Coulter



Artistic concept of the Dawn spacecraft near Mars. Image credit: NASA/JPL

After three and a half years of thrusting silently through the void, NASA's Dawn spacecraft is on the threshold of a new world. It's deep in the asteroid belt, less than 4 months from giant asteroid Vesta.

"We're closing in," says Marc Rayman, Dawn's chief engineer and mission manager. "And I'm getting more excited every day!"

Dawn will enter orbit around Vesta in July 2011, becoming the first spacecraft ever to orbit a body in the asteroid belt. After conducting a detailed study of the uncharted alien world for a year, the spacecraft will pull off an even more impressive first. It will leave Vesta, fly to dwarf planet Ceres, and enter orbit there.

"This is unprecedented," says Rayman. "No spacecraft has ever orbited two target bodies, much less worlds in the [asteroid belt](#). A few probes

have passed through this vast region of space, but not one could stop and develop an intimate portrait of its residents."

A conventional spacecraft gets a boost from a big rocket, then coasts to its target. Carrying enough fuel for making significant changes in speed or direction along the way would make it too heavy to launch.

Dawn is far more fuel efficient. Spanning 65 feet, its solar arrays collect power from the sun to ionize atoms of [xenon gas](#). These ions are expelled silently out the back of the spacecraft by a strong electric field, producing a gentle thrust. The weightless, frictionless conditions of space flight allow this gossamer force effect to build up, so the spacecraft continuously gains speed.

"This spacecraft ultimately achieves fantastically high velocity while consuming very little propellant -- using only a kilogram of xenon every 4 days, though its engines are almost constantly active."

With this system Dawn has been quietly, gradually reshaping its orbit around the sun, slowly spiraling out to its target, getting closer and closer as it loops around.

"By the time the spacecraft is in the vicinity of Vesta, its orbit will be very much like the asteroid's," explains Rayman. "So upon arrival, Dawn can slip into orbit as gently as it's been moving for 3 1/2 years."

A conventional spacecraft screeches into orbit in a single dramatic, nail biting instant. The mission team is usually gathered in the mission control room with their eyes riveted on the telemetry to see that the final critical maneuver goes smoothly.

"With Dawn, there is no one big maneuver, no fiery burn, no single critical moment. Dawn's entry into orbit will be no different from what

the spacecraft does almost all the time, what it's doing as you read this article. In fact, when Dawn sidles into orbit, I might be asleep. Or if it's Friday night I'll be dancing, or if it's Saturday I might be out taking pictures of dragonflies."

But you can bet he'll be in mission control when the pictures start coming in.

"It will be incredibly exciting to watch Dawn close in on Vesta. We'll witness the uninteresting smudge in the first distant images grow into a full-sized world as we loop closer and closer, ending up just 110 miles above the surface. That's closer than the ISS is to Earth! We'll be right there, and if there are no tall trees we'll be safe."

After exploring Vesta for a year, Dawn will take leave of the rocky world as softly as it arrived there, climbing out along a spiral, gradually getting farther and farther away, the loops getting longer and longer, until the asteroid's gravity gently releases the [spacecraft](#). Dawn will again be orbiting the sun on its own, just as it is now. It will complete about two thirds of a lap before arriving at Ceres.

There it will once again slide gently into [orbit](#) around a new world, guided by ion thrusters as silent as space itself.

"Even if we imagined a sound, it would be the faintest of whispers, the softest of sighs. Yet it tells us the secret of making an interplanetary spaceship that can travel to and explore distant, alien worlds, carrying with it the dreams of those on Earth who long to know the cosmos."

Provided by Science@NASA

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