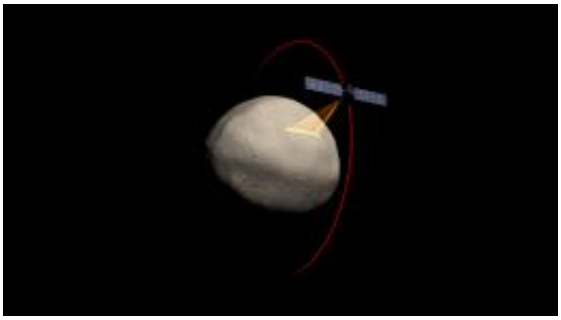
How Capt. Kirk Changed the World

May 5 2010, by Dauna Coulter



An artist's concept of Dawn in "standard orbit" around asteroid Vesta.

"Standard orbit, Mr. Sulu." Captain Kirk barks out the order with such confidence. He knows the USS Enterprise can slip in and out of planetary orbits with ease. But it's only easy in the realm of science fiction. In the real world, such maneuvers have been impossible -- until now.

Enter Dawn, NASA's cutting edge mission to the asteroid belt.

Powered with a futuristic sounding new technology called "ion propulsion," this spacecraft will perform space moves rivaling those of the Enterprise.

At this very moment, Dawn is slowly climbing away from the sun, beyond Mars, on its way to its first destination, asteroid Vesta. Dawn will enter "standard orbit" around this rocky world for a year, exploring its

mysteries.

Then Dawn will do something unprecedented in real-world spaceflight: exit the orbit of one distant body, and fly to and orbit another. The second destination is asteroid Ceres.

"Dawn will be the first spacecraft ever built to orbit two target bodies after leaving Earth," says Marc Rayman, Dawn chief engineer at NASA's Jet Propulsion Laboratory. "There's not even a concept for doing such a mission with conventional propulsion systems. The spacecraft would have to carry so much fuel, it would be too heavy to launch."

Instead, Dawn relies on ion propulsion, which doesn't require a huge spacecraft. Rayman first heard the term years ago while watching - you guessed it -- Star Trek.

Using solar arrays spanning 65 feet, Dawn collects power from the sun to ionize atoms of xenon. These ions are expelled by a strong electric field out the back of the spacecraft, producing a gentle thrust. The weightless and frictionless conditions of space flight allow this gossamer force effect to build up, so the spacecraft gains speed slowly and continuously.

"Dawn isn't exactly a hot rod," says Rayman. "It would take 4 days to go from 0 to 60. But it ultimately achieves fantastically high velocity while consuming very little propellant. It uses only a kilogram of xenon every 4 days."

Typically, conventional rockets thrust for a few minutes at most before they run out of fuel, then they coast to their destination. Dawn’s engines, on the other hand, are almost constantly active.

"Dawn will thrust for 5 1/2 years!" says Rayman. "It's already been

thrusting for 591 days. That's 62% of the time it's been in space."

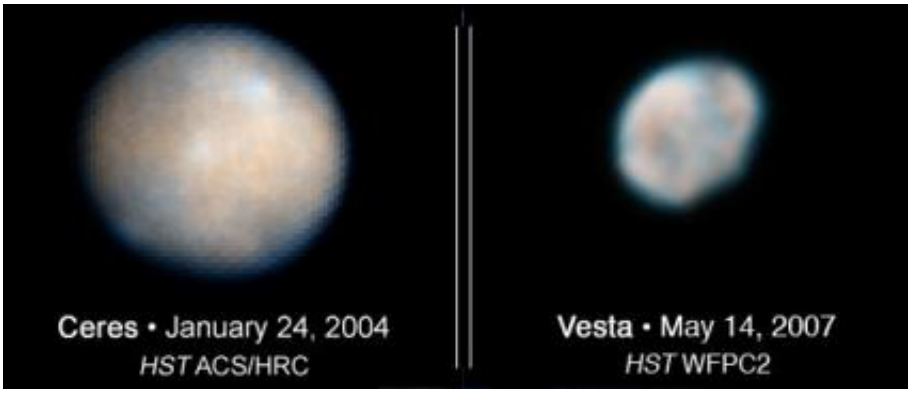
This means Dawn must be very fuel efficient. "A typical Mars orbiter could consume more than 600 pounds of propellants to enter orbit around the red planet," says Rayman. "With its ion propulsion system, Dawn could do it with less than 60 pounds of xenon."

Add all of these advantages together and you get a spacecraft that can accomplish - well - the impossible.

"Dawn is taking us, in the truest sense, up close to two distant, alien, unexplored worlds."

Its destinations -- Ceres and Vesta - are two of the biggest asteroids in the solar system. Indeed, Ceres is so big, it is actually classified as a dwarf planet, and Vesta is not far behind. Yet to date they've been studied only from a great distance, so they're virtually unknown. What is known is that they're not alike.

"Vesta is more like the rocky bodies of the inner solar system, one of which is right under our feet," explains Rayman. "And Ceres is more like the icy moons of the outer solar system. Scientists think it may even have a subsurface ocean of liquid water!"



Hubble Space Telescope photos of Dawn's targets, giant asteroids Ceres and Vesta. [more] Credit: NASA/HST

Dawn's instruments will collect data and images to uncover the secrets these two bodies conceal and perhaps reveal why they're so different from one another even though they inhabit such similar regions of the solar system.

"This mission will help us understand what the conditions were when Vesta and Ceres formed at the dawn of the solar system. It will fit more pieces in the grand puzzle of how our solar system formed and evolved - and perhaps how others do as well."

Executing new cosmic maneuvers, exploring alien worlds, answering profound questions - Dawn has it all. But Rayman thinks the most compelling aspect of missions like Dawn may be that we are, in a sense, going along for a deep-space ride.

"Dawn is taking us all on a virtual trip through the cosmos. It's not just a mission by the JPL team, or by NASA, or by the U.S and its partner countries. It's a mission of humankind -- something that represents all of us who share a spirit of adventure and curiosity, a passion for exploration. It's an extension of ourselves into the universe."

As one Star Trek crew member with particularly pointy ears would say -- "Fascinating."

Source: Science@NASA, by Dauna Coulter

https://phys.org/news/2010-05-capt-kirk-world.html