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This Week

Research Notes

Articles

Cover: Although zebra mussels rarely grow larger than 2 inches, they have become a major problem since their inadvertent introduction in 1985 to the Great Lakes region, where they threaten to starve out native species and clog water intake pipes. Biologists are working on several promising strategies for controlling the troublesome invaders. (Photo: Scott Camazine/Cornell University)

Departments

Letters

A question of speed

"Since its launch on Oct. 18, 1989, Galileo has sped through an intricate route of speed-increasing gravity maneuvers that have already whipped the craft around Venus and Earth," according to "Space Science '91" (SN: 1/12/91, p.28). The article goes on to state that "Galileo should whip by Gaspra at a relative top speed of more than 28,800 kph. . . ."

Top speed relative to what? Earth? Gaspra? If the latter, Galileo, with a speed of 159,000 kph (see below), would have to be overtaking Gaspra to have a speed differential of only 28,800 kph. Gaspra's orbital speed would be 130,200 kph — greater, even, than that of Venus.

According to an earlier article, "Venus gives Galileo a boost in space" (SN: 2/24/90, p.119), Galileo, after swinging by Venus and Earth, has a speed (I assume relative to the Earth) of about 159,000 kph (134,000 kph after leaving Venus, plus 25,000 kph from the Earth flyby).

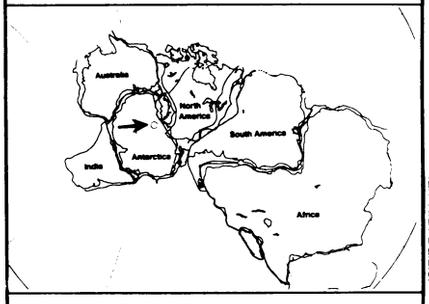
Now, any speed increase attributable to a planet flyby must be from the orbital speed of the planet, not the gravitational attraction, because gravity in equals gravity out. How does Galileo gain speed on its second Earth flyby if its speed is already 159,000 kph and Earth's orbital speed is only 107,192 kph?

Howard P. Caudle
Webster, N.Y.

In short, Galileo gained speed on the way to Venus, since the spacecraft was "falling" into the sun's "gravity well," but is now slowing down on its way out. In fact, on Jan. 11, 1992, when the craft reaches its most distant point from the sun after rounding the asteroid (about three months after the actual asteroid flyby) and prepares to start "falling" sunward again, its speed will have dropped to only 53,700 kph.

Galileo will be able to reach that point because of the speed it gained during the Feb. 10, 1990, Venus flyby and the Dec. 8, 1990, Earth flyby. Galileo's route was designed to give it enough net speed to reach its primary objective at Jupiter, but the complex trajectory involves speeding up on the way to Venus, then losing some of that gain on the outbound trip past Earth to Gaspra, and accelerating again as a result of heading back toward Earth. Thus, Galileo will not reach the 159,000 kph speed you mention. Its maximum speed, about 146,000 kph, was achieved about two weeks after the Venus flyby, when the craft came closest to the sun. — J. Eberhart

CORRECTION



Ian W.D. Dalziel

In this map from "Married to Antarctica" (SN: 4/27/91, p.266), a printing error omitted the circle showing the present-day position of the South Pole. The map depicts a possible arrangement of continents around 675 million years ago.