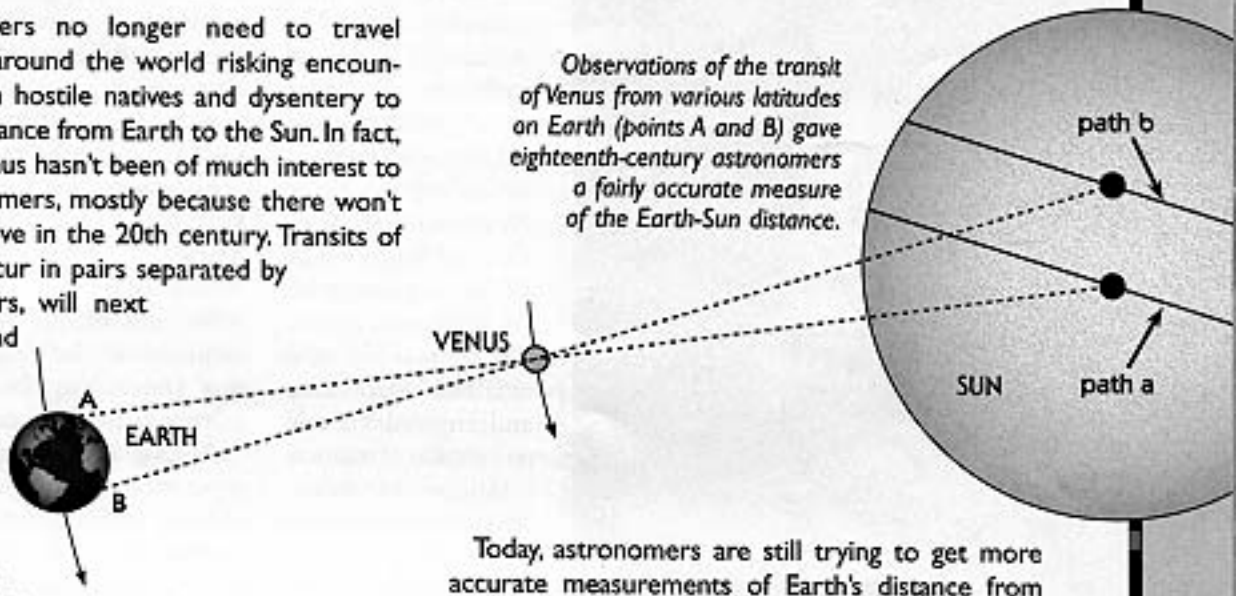
Transits Past and Future

Astronomers no longer need to travel halfway around the world risking encounters with hostile natives and dysentery to measure the distance from Earth to the Sun. In fact, the transit of Venus hasn't been of much interest to modern astronomers, mostly because there won't be one to observe in the 20th century. Transits of Venus, which occur in pairs separated by about eight years, will next occur in 2004 and 2012.



Observations of the transit of Venus from various latitudes on Earth (points A and B) gave eighteenth-century astronomers a fairly accurate measure of the Earth-Sun distance.

Edmond Halley first proposed using observations of the transit of Venus to measure the Earth-Sun distance in 1716. His method required that two or more observers at different latitudes (see diagram) note the paths Venus describes across the surface of the Sun. The angular separation of the paths yields Venus' distance from the Sun. Given the distance from Earth to Venus, which had been known through careful observations of their orbits since the time of Copernicus, Earth's distance to the Sun is a matter of simple addition.

Expeditions to observe the transit of Venus from various points around the globe were undertaken in 1761 and 1769. Though the first attempt at making coordinated observations yielded few scientific results, Cook and Green led one of 76 observing parties for the latter. The combined observations led to calculations of the Earth-Sun distance of between 92 and 96 million miles.

Observations of the transit of Venus were still important to nineteenth-century astronomers when the most recent pair occurred in 1874 and 1882. Captain Ralph Chandler of the U.S. Navy escorted five observing parties to the southern hemisphere aboard the USS *Swatara* to record the 1874 event.

Today, astronomers are still trying to get more accurate measurements of Earth's distance from the Sun in order to better characterize the behavior of Earth's orbit. Their methods no longer involve observations of the transit of Venus nor simple tools like Cook's quadrant and basic mathematics.

According to Art Whipple, an astronomer at the University of Texas McDonald Observatory, Earth's orbit is measured today using laser ranging to the Moon and artificial satellites, radio communications to space probes like Galileo and Voyager, and very long baseline interferometry. The data from these observations are put into complicated computer models that correct for observational errors. A better understanding of Earth's orbit helps scientists study the mass of the Sun, Moon and planets; test Einstein's Theory of General Relativity; and study Earth's interior.

Astronomers certainly won't ignore the next transit, due on June 8, 2004, though its value to our understanding of the solar system has been diminished by more accurate modern methods. Other observations may be planned, however, perhaps to gain new insight into the content of Venus' upper atmosphere by watching it against the enhancing backdrop of the solar disk. ***Doug Addison***

Cook dubbed his observing site "Fort Venus."

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