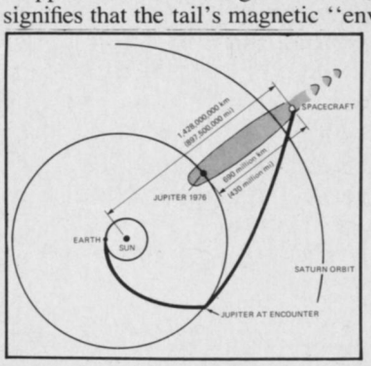
SPACE SCIENCES

The titanic tail of Jupiter

The Pioneer 10 spacecraft, which flew past Jupiter in December 1973, has apparently flown through the tail of the giant planet's magnetic field 690 million kilometers further from the sun than Jupiter itself, outside even the orbit of Saturn. It happened on March 19, when the spacecraft's solar wind detector dropped to a zero reading for more than 24 hours. Such a reading signifies that the tail's magnetic "envelope" may have shut out the solar wind particles.



"It is just barely conceivable that the solar wind could have died completely for a whole day without our being in the tail," says Pioneer project scientist John Wolfe of NASA's Ames Research Center, "and we'll know more when we have complete tracking data. But we believe we've found that Jupiter has a very stretched-out magnetic envelope, or tail." There was also some speculation that Pioneer 10 might merely be in a "magnetic bubble" broken off from the tail, but Wolfe believes that the long duration of the zero-solar-wind period means that the spacecraft crossed an intact portion of the tail. If so, Jupiter's magnetotail is at least 10,000 Jupiter radii in length, compared with about 1,000 earth radii for earth's magnetotail. Saturn should enter Jupiter's magnetotail every 20 years. When that happens—as it will next in April 1981—Saturn's outer radiation belt should be disturbed. Spacecraft may attempt to monitor evidence of that event.

In addition, when Pioneer 10 crossed the Jovian magnetotail, it was 6 degrees—about 100 million kilometers at that distance from the sun—above the plane of the ecliptic. Pioneers 10 and 11 have both detected enough solar wind turbulence at Jovian distances and beyond to account for the wind's blowing the magnetotail "upward" by that amount.

Another origin for the moon

No Lunar Science Conference, such as the one at NASA's Johnson Space Center in Houston two weeks ago (SN: 3/27/76, p. 196), would be complete without a new theory of the origin of the moon. A key constraint on such theories, according to A.G.W. Cameron and W.R. Ward of the Center of Astrophysics in Cambridge, Mass., has to be the "abnormally large" specific angular momentum of the earth-moon system compared with the other planets in the solar system. At an early stage, when the moon was close to the earth, most of the angular momentum resided in the earth's spin, a spin, they suggest, presumably imparted to the protoearth by a collision with a major secondary body possibly as massive as Mars.

The protoearth and the secondary body, they theorize, both had iron cores and silicate outer layers. The silicates would have vaporized and blown off, while the iron would have fragmented and collapsed back to the earth (thus accounting for the still-unexplained paucity of metallic iron on the moon), leaving the silicates to condense into a disklike ring similar to that proposed in the past by A.E. Ringwood of the Australian National University. The disk would then condense into the moon.

The resulting moon would be deficient in volatile elements (as Apollo data indicate), because most of the fine grains into which the volatiles condensed would have been driven completely out of the system by the rebound energy following the collision. There would also be a slight enrichment in crustal elements such as calcium and aluminum relative to the earth—Cameron estimates about 2 to 1, which is not inconsistent with recently revised lunar heatflow measurements.

This theory, say the authors, applies only to a planetary body such as the earth, where the escape velocity is sufficient to vaporize silicates. "If a similar large collision happened in the late stages of accumulation of Venus," they report, "the orbit of any satellite formed would have decayed into the planet long ago."

Safer facility sought for moonrocks

With interest in the Apollo lunar samples still high and with no return visits yet in sight, lunar researchers are seeking an improved curatorial facility to provide safer storage and more workspace for the priceless rocks. Participants at the Lunar Science Conference in March were signing petitions in support of funding for the facility. Funds were not approved by the House of Representatives but have been endorsed by the Senate space committee. The proposed facility, an addition to the present one at Johnson Space Center, would be designed to resist flooding and other adverse environmental characteristics of the area.

Five new satellites in orbit

Five separate U.S. space satellites, representing both military and civilian interests, have been launched into orbit recently, four of them aboard a single rocket.

Two Naval Research Laboratory satellites, SOLRAD (SOLar RADiation) 11A and 11B, were sent aloft March 14 to measure the sun's X-ray, ultraviolet and proton emissions as well as solar wind fluxes. Since SOLRAD 1 was successfully orbited on June 22, 1960, the ongoing program has provided reams of data, including such milestones as the passage of SOLRAD 8 through an eclipse shadow over Greece in 1966. Part of the solar-flare alert network, SOLRAD 10 was standing watch during the Apollo lunar missions and later during Skylab. The latest satellites in the series will provide data to a system that uses solar X-ray flux to help predict the duration and intensity of fadeouts in shortwave radio communications.

The same Titan IIIC rocket that carried the SOLRAD probes also lofted a pair of Lincoln Laboratory Experimental Satellites, LES 8 and 9, built at the MIT facility for the U.S. Air Force. Powered by nuclear generators rather than conventional batteries or solar cells, the devices are helping to evaluate techniques of "satellite survival and dependability in a hostile environment," using such aids as signal-processing circuits designed to resist electronic jamming.

In the private sector, the second of RCA Corp.'s commercial, domestic communications satellites, Satcom II, was launched March 26 to provide voice, television and data relay for the contiguous United States and Alaska. Satcom I, launched Dec. 12, is now in synchronous orbit over the equator at about 119°W, due south of Los Angeles. Satcom II was aimed at about 135°W, south of Juneau, Alaska.

Last man on the moon to retire

Irony. It was on the first day of this year's Lunar Science Conference that NASA announced the July 1 retirement of veteran astronaut Eugene A. Cernan—the last man on the moon. Cernan, who walked in space during Gemini 9 and flew the Apollo 10 lunar module to within 10 miles of the moon's surface, followed astronaut Harrison H. Schmitt up the LM ladder as they prepared to return to earth aboard Apollo 17 from the moon's Sea of Serenity.

Of the 12 men who have walked on the moon, only three, after Cernan, will still be with NASA: Alan Bean (Apollo 12), David Scott (Apollo 15) and John Young (Apollo 16), and only Bean and Young remain on flight status.