Deep-dipping through the atmosphere

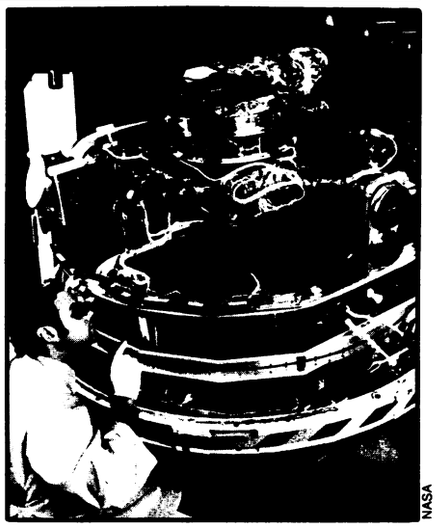
The first deep-dipper was AE-C. Third in the series of Atmosphere Explorer satellites, it was launched Dec. 15, 1973, newly equipped with a rocket motor to let flight controllers repeatedly guide it as low as 115 kilometers above the ground, then push it back up again so that atmospheric drag would not pull it to an early grave (SN: 1/5/74, p. 12). Heavily instrumented to study energy transfer processes in the outer atmosphere, it has been providing data to an unusual distribution network, designed to let its various participating scientists around the country receive their information in a hurry so that they could plan new activities for the probe on short notice. Last week, a second deep-dipper joined the first.

Launched Oct. 6, AE-D uses the same data hotline to speed results to 15 investigators in six states. It carries largely the same sort of temperature, density, composition and particle instrumentation, including an ultraviolet spectrometer to measure the distribution of nitric oxide, a significant factor in the control of earth's protective ozone layer. Unlike its predecessor, however, it is circling the earth in an orbit that carries it over the poles, enabling it to see areas that were AE-C's "blind spots."

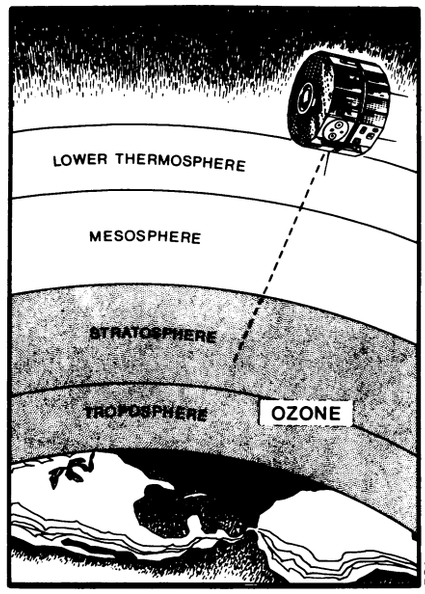
Direct ozone measurements will be made by the next satellite in the series, AE-E, now set for launch Nov. 13. The decision to add the ozone detector to the already instrument-loaded probe was made only last spring, which amounts to almost a crash program in the painstaking work of integrating satellite payloads. The satellite will be launched into an equatorial orbit, where the direct influx of ultraviolet radiation from the sun will give it a good look at what is presumably one of the most active regions of ozone production in the upper atmosphere.

Ozone is not the only area in which the deep-dippers are expected to yield significant results, however. Before the first of them (AE-C) was launched, for example, its planners assumed that the atmospheric region from about 130 to 300 km above the ground would be relatively predictable and stable. Instead, says one National Aeronautics and Space Administration researcher, it revealed fickle weather patterns with winds 10 times as severe as those near the surface. "The winds may be measured blowing from west to east at 160 knots, and a few kilometers higher they will be coming from the opposite direction at the same speed."

The quick-look data-distribution network may be of particular value in studying the effects of increases in solar activity, including such phenomena as aurorae and geomagnetic storms. If a solar flare or other disturbance occurs, a central computer at NASA's Goddard Space Flight Center in Maryland can coordinate the activities of the scientists working with the satellites so that they can use their orbiting instruments to study the effects of the event while it is actually happening. The scientists can then decide, for example, whether the satellite should be reoriented, whether its orbit should be altered (although "deep-dipping" ordinarily would not be done on short notice), or whose data rates ought to be switched. □


NASA

Newest deep-dipping satellite is AE-D.



RCA

AE-E will monitor ozone directly.

Pineal gland: Seat of solar readout?

The brain, according to the French philosopher René Descartes, is the "marriage bed," the point of interaction between the spirit and the body. He and other philosophers since him have maintained that the seat of the soul, of consciousness, is the pineal gland, a tiny invagination of tissue sitting deep in the brain. This idea has been completely unraveled by the generations of mechanistic anatomists and physiologists since Descartes, but the pineal gland, the mystical "third eye," is being assigned some surprisingly important roles by modern researchers.

The pineal gland in higher vertebrates is a phylogenetic carry-over from the "third eye," an extra site of photoreceptive tissue found in a few primitive vertebrates. Although there is no photoreceptive tissue in the mammalian pineal gland, it seems to have a connection with rhythmicity—the animal's interpretation and response to changing day length. No one is exactly sure how to explain this, but convincing evidence of pineal interaction with day length and reproduction was reported in the Oct. 17 SCIENCE.

A team of biologists from the University of Texas at Austin, Fred W. Turek, Claude Desjardins and Michael Menaker, designed an experiment to try to clear up some confusion over the role of the pineal hormone melatonin in mammalian reproduction. Some researchers have found that it decreases gonad size. Some have found that it increases gonad size. And some have found no effect at all. The Texas team, using an improved system for delivering melatonin to the test animals, have found that melatonin has both antigonadal and progonadal effects. This looks just as confusing at first glance, but it actually begins to explain the pineal role in reproduction, Turek says.

Turek, who is now at Northwestern University, explained the experiment and its significance this way: By implanting slow release capsules containing different levels of melatonin into several test groups of male golden hamsters, the two effects of melatonin were revealed. In animals exposed to long daylengths, the testes shrank. In animals exposed to short day lengths, moderate melatonin levels prevented shrinkage.

"My thesis," Turek told SCIENCE NEWS, "is that the pineal gland may function as a 'middle organ' between the outside environment and control of the internal organs." In spring, as the day-length increases, he says, gonad size increases in many animals (humans excluded). There must be some link between the circadian clocking mechanism which "measures" daylength and the control over reproductive readiness. This link, Turek says, might be some pineal substance acting either on the hypothalamic-pituitary system, or directly on the gonads. Whether melatonin is the only or most important substance that links daylight to reproductive control in the hamster remains to be established, he says, but the experiment does show melatonin can have "clear and dramatic effects." □