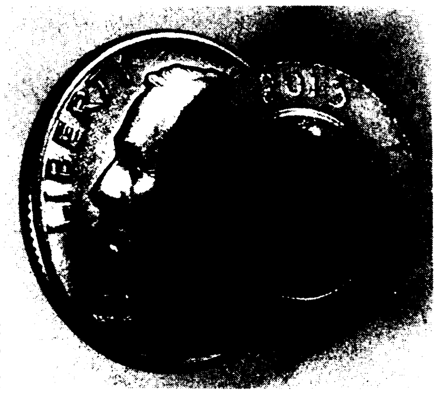
Chip logs a year's temperature history

Aircraft tires overheat every time they're used. "After enough times they [will] burst," notes Tomas Hirschfeld, a chemist at Lawrence Livermore National Laboratory in California. How quickly heat degrades a tire essentially depends on the cumulative exposure to high temperatures that each tire receives. However, because airlines today have no way of knowing quantitatively any specific tire's temperature history — and hence theoretical lifetime — all tires are replaced after only a fraction of their potential life has elapsed.

At perhaps $50,000 per tire, Hirschfeld says, this conservatism is costly. As with many an appliance and electronic component, he notes, "If you knew its temperature history, you would have a better idea of its useful life." And he's just developed a rugged temperature recorder (shown at right, resting on a dime) to do that.

For his sensor, Hirschfeld tops a silicon chip with a tapered, wedge-like layer of lithium. Lithium will diffuse into silicon at a rate determined by ambient temperature and the initial depth of the lithium layer. Because small amounts of lithium will alter the electrical resistivity of silicon, a temperature history can be read from resistivity variations caused by diffusing lithium. And since the lithium layer's starting depth varies continuously across the chip, temperature will affect each point on the chip's surface differently.


Lawrence Livermore Natl. Lab.

The sensor can somehow be placed into the environment it's to record and left for one year. After removal, resistivity measurements are taken at roughly 365 points across its surface. These resistance data versus chip positions can be translated through mathematical algorithms into a readout of daily average temperatures. Though this system is designed to operate from room temperature to 200°C, the chip's materials can be tailored for other temperature regimes. And thinning the initial lithium wedge makes possible chips that collect hourly averages on sensors that last weeks. Advantages, aside from size and needing no external power source, include their potential low cost — perhaps $1 to $4. *—J. Raloff*

Synfuels Corp. slashed

The U.S. Synthetic Fuels Corporation (SFC) may lose $5 billion — more than one-third — of its budget, as House Democrats and Republicans banded together last week to pare that controversial agency's funds (SN: 8/4/84, p. 74).

This budget cut, which has not yet cleared the Senate, is less than President Reagan has asked Congress to cut, and is also less than House critics originally wanted. But House Majority leader Jim Wright (D-Texas) offered the $5 billion figure as a compromise to keep alive the troubled agency, which is without a quorum on its board of directors and hence unable to work at its mission of prodding private industry into developing technologies for substitute fuels.

Despite the cut, SFC "will still be able to do a well-rounded program," says firm spokeswoman Missy Malloy.

The SFC was created with the 1980 Energy Security Act. In the wake of economic upheavel wrought by 1970s oil embargoes, the quasi-governmental firm was to hand out loan guarantees and price supports to stimulate production of synthetic fuels. Since then, the price of oil has dropped, making expensive substitute fuels look unattractive to private industry, both critics and advocates agree. □

The Ariane family: Growing up

The Ariane rocket, Europe's competition for the U.S. space shuttle in the business of launching satellites, on Aug. 4 passed a major milestone on the way to its goal of offering the flexibility that its marketplace demands.

Last week's liftoff (bearing a European communications satellite called ECS-2 and a French one named Telecom 1A) was the first by a more powerful version called Ariane 3, capable of lifting up to 2,585 kilograms and the heart of which, also usable on its own, is an enhanced Ariane 1 called Ariane 2.

Unlike the reusable shuttle, whose huge cargo bay enables it to carry numerous combinations of satellites large and small, the conventional single-use Ariane is intended to achieve the same adaptability by providing a whole family of related boosters.

Beginning with its maiden flight on Dec. 24, 1979, the first nine Arianes — four test flights, four "promotional" launchings and one paid-for, commercial venture — all were the basic version, called Ariane 1. It is capable of putting 1,825 kg of mass into an orbit from which each satellite can be placed by its own built-in "kick motor" into a fixed, "geosynchronous" orbit of the sort sought for communications satellites.

Starting with Ariane 1, increase the combustion chamber pressure in all three of the rocket's stages, enrich the propellant in the first stage, soup up the engine in the third and add more fuel for a longer "burn time." That's Ariane 2, which passed its first flight test last Saturday along with the two solid-fuel strap-on boosters which made it Ariane 3.

And beginning in 1986, Ariane 4 will be offered in six different versions of its own, with payloads of up to 4,200 kg. Your basic Ariane 4 will have no strap-ons, but it will come with the higher chamber pressure and still more propellant — and it will be available with the two solid boosters, or four, or two larger, liquid-propellant boosters, or four of those, or even two of each kind.

Ariane's services are marketed by Arianespace, Inc., established for the purpose by the 36 principal European aerospace and electronics firms, 13 European banks and the French space agency. Its next four launchings will all be Ariane 3s, each carrying a pair of communications satellites. Next may be an Ariane 1 with the French SPOT earth-resources satellite, followed by another with the European Space Agency's Giotto probe, bound for Comet Halley. Arianespace now has firm launch commitments for 28 satellites, and options for 19 more. *—J. Eberhart*

Worrisome weather-watch

Now heading eastward across the United States is a satellite that U.S. officials hope will be in position to spot hurricanes before the hurricane season peaks late this month. On July 22 and 29, the National Oceanic and Atmospheric Administration's GOES-5 satellite, stationed at 75°W longitude (about that of the Caribbean), lost the use of two light bulbs in an aiming system that had enabled it to take images of weather systems over the eastern United States every 30 minutes.

To compensate for the loss, NOAA officials have signaled the satellite's successor, GOES-6, to move from its usual station at 135°W (between the longitudes of Hawaii and California) to 98°W (aligned with central Texas). From there, it will be able to cover the whole country, though not far enough out into the Atlantic and Pacific to give the advance storm warnings provided by the pair of satellites.

NOAA is also using images from the European Space Agency's Meteosat 2, and hopes to use others from another satellite just launched by Japan. The polar-orbiting NOAA 6 and 7 satellites are also being enlisted, though their pictures come only twice a day. If GOES-6, too, should fail (like four of its predecessors), Defense Department satellites may be added. The next GOES satellite (GOES-7) is scheduled for launch in the spring of 1986, according to NOAA. □