the new law will, indeed, be used as intended.

This political competition became evident at the bill-signing ceremony. Conspicuous by his absence was Sen. Edmund S. Muskie (D-Me.), chairman of the Senate air and water pollution subcommittee, which had reported out the bill in essentially the form the President signed it. An Administration official commented that the President did not regard the bill as "the Muskie bill," but rather as a composite effort that included provisions suggested by the Administration. Whoever is credited, there is no doubt the bill includes stringent provisions the Administration had earlier regarded as too tough on industry.

The most discussed such provision is the one which will require the automobile industry to install emission controls on 1975 models roughly 90 percent more effective than those on 1970 models. Under previous law, this goal had been set for 1980. The industry has protested at hearings that the necessary technology cannot be achieved in time. But Muskie and others insist that a genuine effort will produce the necessary results.

Although the auto emission standards received the greatest publicity, other provisions might have much more far-reaching effects. For example, even if the 1975 deadline is achieved on automotive emissions, unless equipment that can be retrofitted can be devised, most cars on the road for the following several years will produce higher levels of emissions. And there is no assurance that the emission controls will continue working the way they are supposed to after a car is a few years, or even a few months, old.

The bill recognizes these obstacles by establishing national ambient air standards. States and cities will have to meet them regardless of the state of the art of emission controls. The only way the ambient air standards can be met, says a Muskie aide, is through drastic curtailment of the numbers of automobiles allowed to enter central cities.

Chicago is a case in point. Illinois air quality standards now limit carbon monoxide to about 5.9 parts per million, based on an annual geometric mean of 24-hour averaging of ambient levels at any given point. In fact, levels in downtown Chicago in 1967, the last year Federal readings were taken, were about 14 parts per million, more than double the allowed level. Officials of the Air Pollution Control Office of the Environmental Protection Agency claim that calculations of carbon monoxide and other auto pollutants, based on the current emission standards, show there should have been at least some reduction since 1967. But they admit they have no empirical evidence this is so.

Under the new law, the setting of standards will be taken out of the hands of the states and given to EPA. And although the local governments will be responsible for implementation plans, there are strict criminal provisions in the law for Federal monitoring and enforcement of the standards. A further provision seems to insure that EPA will not be derelict: It provides for waiver of the concept of "sovereign immunity" (SN: 9/26, p. 273) so that ordinary citizens, or citizens' groups, can sue EPA if they feel the agency is not doing its job.

The same national standards and enforcement apply not only to pollutants from automobiles but also from industry. Many cities in the United States now have ambient levels of sulfur oxides exceeding safe levels (SN: 8/29, p. 187), despite the fact that ambient air standards have been adopted by many states and regions. Under the new law, these jurisdictions will have to formulate clearcut implementation plans to meet the new national standards. If they fail, then EPA can step in and implement them. If necessary, Federal agents may close down factories or invoke criminal provisions of the law.

EPA officials were meeting this week to work out details and to begin to formulate the national standards—at least for the pollutants for which criteria now exist (particulates, hydrocarbons, sulfur oxides, photochemical oxidants and carbon monoxide). Two sets of standards will have to be promulgated: primary ones, aimed at a minimal level of control necessary to protect public health, and secondary standards aimed at the more nebulous goal of "public welfare." States will have nine months, after hearings, to develop and adopt implementation plans for the primary standards. More time is allowed for adoption of secondary implementation plans. □

THREE-MONTH RESPITE

Supersonic transport

Sen. William Proxmire (D-Wis.), in the waning hours of the 91st Congress last week, agreed to end his anti-SST filibuster in favor of a continuing resolution for Department of Transportation funding at the previous year's level until March 30. This means that about another $50 million—in addition to the $110 million already appropriated under earlier such resolutions—will become available for the controversial airliner. The total is considerably short of the $290 million DOT wanted for the current fiscal year. In exchange for his concession, Proxmire insisted upon, and got, a promise of a clearcut up-or-down vote in both Houses by March 30. □

SOLAR SYSTEM

Through a cell of hydrogen

Hydrogen is the lightest of the chemical elements and possesses the simplest atomic nucleus. Perhaps for this reason it is the most abundant element in the universe. Large clouds of hydrogen pervade the Milky Way galaxy. Over the last 20 years astronomers have been able to make contour maps showing its density in different places.

Most of the hydrogen that has been studied so far lies at great distances from the earth. Now data from an Orbiting Geophysical Observatory satellite indicate that the solar system is in the middle of a turbulent cell of neutral interstellar hydrogen that appears to be crossing the solar system's path in space.

(The word cloud has been used to describe the local turbulence, but Dr. Gary Thomas of the University of Colorado, one of the discoverers, prefers to say turbulent cell, because, he says, "cloud" implies density, and the local cell appears to be less dense than the average of interstellar gas.)

The hydrogen cell is at least 300 times as long as the mean radius of the earth's orbit, or 45 billion kilometers. It appears to be moving from the constellation Taurus toward the constellation Sagittarius, a direction that makes an angle of about 60 degrees with the direction the solar system moves through space. After correcting for the motion of the solar system, the cell's velocity appears to be about 50 kilometers per second. Co-discoverers with Dr. Thomas are Dr. Charles Barth and R. F. Krassa of Colorado and Drs. Jacques Blamont and Jean Bertaux of the University of Paris.

The cell was discovered by its scattering of the so-called Lyman alpha emission of the sun. Lyman alpha is a particular pattern of ultraviolet frequencies given off by hydrogen atoms in the sun. The hydrogen atoms of the cell reflect it, and the brightness of the reflection reveals their presence.

The brightest spot, representing the head of the cloud, lies in the direction of Sagittarius. Observations were made at four points as the earth went once around its orbit. In these observations the apparent location of the bright spot changed by as much as 40 degrees. If the change is interpreted as being due to the change in the point of view rather than any motion of the spot itself, then the size of the change indicates the hydrogen is very near the earth, says Dr. Thomas.

The temperature of the hydrogen is estimated from the brightness of the reflections to be about 10,000 degrees K. Its density appears comparable to that of the solar wind or about one

particle per five cubic centimeters.

The solar wind, which is composed of ionized particles and is about five times as hot as the hydrogen, serves as a kind of shield for the sun and inner planets. It carves out an ellipsoidal cavity in the hydrogen cell.

At the boundary between the solar wind and neutral hydrogen a kind of electrical friction keeps the two distinct. Hydrogen atoms trying to pass into the solar wind are ionized, while protons passing into the hydrogen cell will pick up an electron and be neutralized.

The cavity extends about 750 million kilometers from the sun, about to the orbit of Jupiter. The estimate of the hydrogen cell's velocity was derived from this distance by calculating the speed necessary to drive the hydrogen that close to the sun against the pressure of the solar wind. If the velocity is accurate and the hydrogen cell is no more than 45 billion kilometers long, it could take the solar system another 50 years or so to pass through it.

To find out more about the cell, the discoverers are putting ultraviolet sensing equipment on the two Mariner probes scheduled to orbit Mars next year. This will bring observation 75 million kilometers closer to the hydrogen than the OGO-5 satellite did. They also hope to put equipment on the spacecraft making the grand tour of the outer planets in the late 1970's. □

ATMOSPHERIC MONITORING

Prototype for global network

A number of scientists have been pointing out recently the need for some kind of global monitoring system to determine both what effects man has on the environment and what changes are occurring naturally (SN: 10/10, p. 300). Some efforts have been made in this direction, but as yet no comprehensive long-term system has been set up.

Scientists at the National Center for Atmospheric Research in Boulder, Colo., are now developing a prototype reconnaissance station as the first step toward a worldwide network to monitor the chemical composition of the atmosphere. The National Oceanic and Atmospheric Administration and the National Air Pollution Control Administration have expressed in taking part in the project.

Some of the atmospheric constituents the NCAR scientists would like to keep an eye on are:

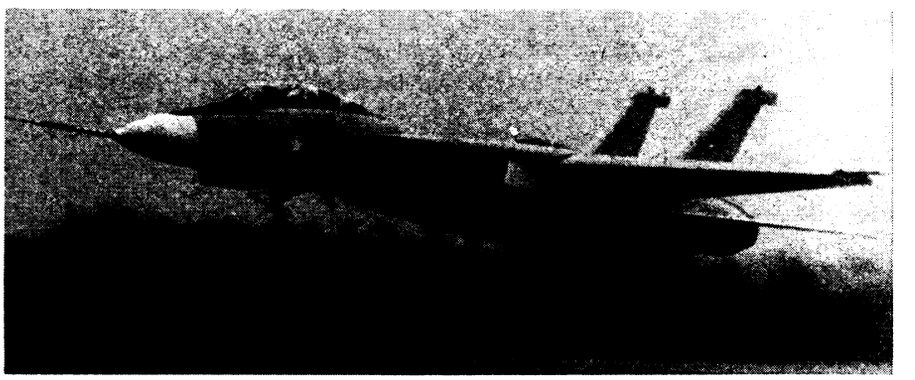
- Particles, including their concentration, size distribution and physical and chemical nature;
- Gases that play a role in producing particles, including hydrocarbons, sulfur dioxide, hydrogen sulfide, ammonia, ozone and nitrogen oxides;
- Carbon monoxide and carbon dioxide;
- Certain persistent chlorinated hydrocarbons that enter the air as insecticides or in the form of industrial pollutants;
- Turbidity, or dustiness.

Once the first station has been operated for a few months to shake out bugs, the NCAR scientists hope to install at least five or six others in such places as Alaska, Hawaii, Antarctica and the Amazon jungle. These stations would ultimately become part of a global network operated by some international group, such as the World Meteorological Organization.

Then, says Dr. Richard D. Cadle, head of NCAR's atmospheric chemistry department, "We may begin to get the answers that we need to some critically important questions about the changing chemistry of the earth's atmosphere." □

F-14

The felled bird



When the Navy's high performance fighter, the F-14, has completed its test program this year, it is expected to be more than a match for anything flying —including the Mach 3 Russian Mig 23 and the Air Force's F-111. Thus the loss of the first test airplane last week was more than a crushing blow to the Grumman Corp., the contractor. The mishap necessitates both a tedious examination into the sequence of events and failure that felled the plane and a reshuffling of the test program to accommodate the loss.

The sleek, twin-tailed jet, dubbed Tomcat, is the Navy's choice over the F-111B—the ill-fated Navy version of the controversial TFX that turned out to be too heavy for carrier flights. Wing sweep can automatically be varied from 20 to 68 degrees. Its maximum speed will be in excess of Mach 2.

Tomcat 1, the first F-14 produced, was on its first real test flight Dec. 30, after a successful 10-minute run Dec. 21. The test flight was scheduled for 90 minutes. But after about 30 minutes the pilots reported the first sign of trouble—a power transient. What actually happened to the $11 million bird is not yet known. But from preliminary accounts, all three hydraulic systems failed.

The pilots used a secondary reserve system of pressurized nitrogen gas to lower the landing gear. They were on the glide approach path for landing when the plane began oscillating vertically out of control. The pilots ejected safely from 300 feet about a mile short of the runway.

Each of the aircraft's three hydraulic systems operates with a different power source, but they are interchangeable at points. The primary system, for operating such things as accessories, the refueling probe and the flaps, is backed up by a secondary or flight-control system, which is used mainly for the rudders and elevators. The third system, a back-up flight-control system, should have been able to hold the plane on its approach glide path. The fact that it too failed indicates a malfunction at a common point in all three systems, such as a leak of hydraulic fluid.

The plane was the first of 12 test planes to be delivered to the Navy—one each month. The Navy recently contracted for the production of 26 planes to be delivered in 1972. The total contract is for research and development and an option for 469 aircraft, at a cost, including R&D, of about $13.5 million each.

Each of the 12 test planes is configured to test different performance capabilities. Ironically, the lost plane, delivered a month ahead of schedule, was to test some 500 points on the flight-control system. The remaining 11 were to test such data as engine performance, low-speed flight characteristics and the plane's Phoenix missile system. One of the 11 will now have to be reconfigured to accommodate the features that were lost on the first plane. □