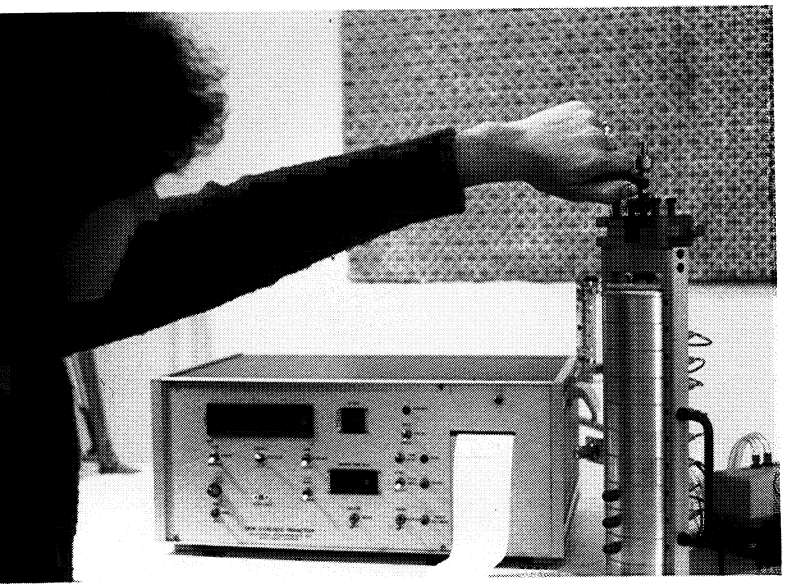

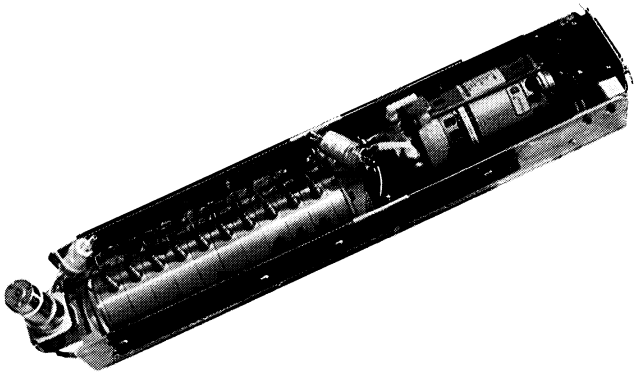

Atmosphere Analyzer

In air pollution studies, it is important to determine the quantities and sizes of aerosols in the atmosphere at a particular time. Aerosols are tiny solid particles or liquid droplets deposited in the atmosphere by natural events—such as volcanic eruption—or by human activities. Measuring them is very difficult because the ratios of the different contaminants are constantly changing. A NASA-developed technology—a quick and accurate method of detecting minute amounts of mass loadings on a quartz crystal—offers utility as a highly sensitive detector of fine particles suspended in air. When it is combined with a suitable air delivery system, it provides immediate information on the size distribution and mass concentrations of aerosols. The technology employs a dual-crystal sensor whose oscillating frequency changes in direct proportion to the amount of mass collected on the sensor. Electronic processing of the frequency changes provides mass collection information within seconds of a measurement.

Originally developed at Jet Propulsion Laboratory, the technology is incorporated in the device shown (above). Known as the Model PC-2 Aerosol Particle Analyzer, it is produced in both airborne and ground-use versions by California Measurements, Inc., Sierra Madre, California. The airborne PC-2 consists of a sensing pod (left) and an electronic control unit inside the airplane. The pod has 10 stages in tandem corresponding to particle sizes. Each stage is equipped with two sensing crystals and each has an inlet of decreasing size, so that the largest particles in an air sample are captured by the first stage and smaller particles flow to the next stage, until the system has sorted all particles into 10 size gradations. The crystal sensors report the particle concentration in each stage. The control unit provides a printout which

includes the time of the sampling period, the total mass concentration of aerosols and the concentration in each stage; an accompanying bar chart breaks down particle size distribution within the sample.

William Chiang, a former Jet Propulsion Laboratory engineer, founded California Measurements and obtained a NASA license for the multiple crystal oscillator technology. Initially, he developed—with Langley Research Center assistance—a particle analyzer for NASA use; later the company produced the modified PC-2 for commercial applications. Brunswick Corporation, Costa Mesa, California, uses the device for atmospheric research and in studies of smoke particles in fires. The PC-2 is used by pharmaceutical and chemical companies in research on inhalation toxicology and environmental health. It is also useful in testing various filters for safety masks and nuclear installations.

Among other examples of the system's utility, is an analyzer-equipped airplane, bottom left, flying into the smoke plume left by a launch vehicle blasting off from Kennedy Space Center; this is part of a Langley Research Center program for analyzing the effluents from solid rocket boosters. Along with other sensors, the device is flown routinely aboard Ames Research Center and Wallops Flight Center aircraft in studies of the effects of atmospheric aerosols on climate. Sampling volcanic effluents is another use of the device; at right is the Caribbean volcano La Soufrière on St. Vincent Island, which was sampled by a NASA-Wallops aircraft during a quiet period after an eruption. Below, the PC-2 is shown under the wing of a research airplane operated by the National Center for Atmospheric Research (NCAR), Boulder, Colorado; NCAR has used the device in several studies of aerosols and volcano effluents. Below right, a researcher is sampling within the crater of Mt. St. Helens, part of a 1981 U.S. Geological Survey test following the eruption of the preceding year.