

# NASA TECH BRIEF

*NASA Pasadena Office*

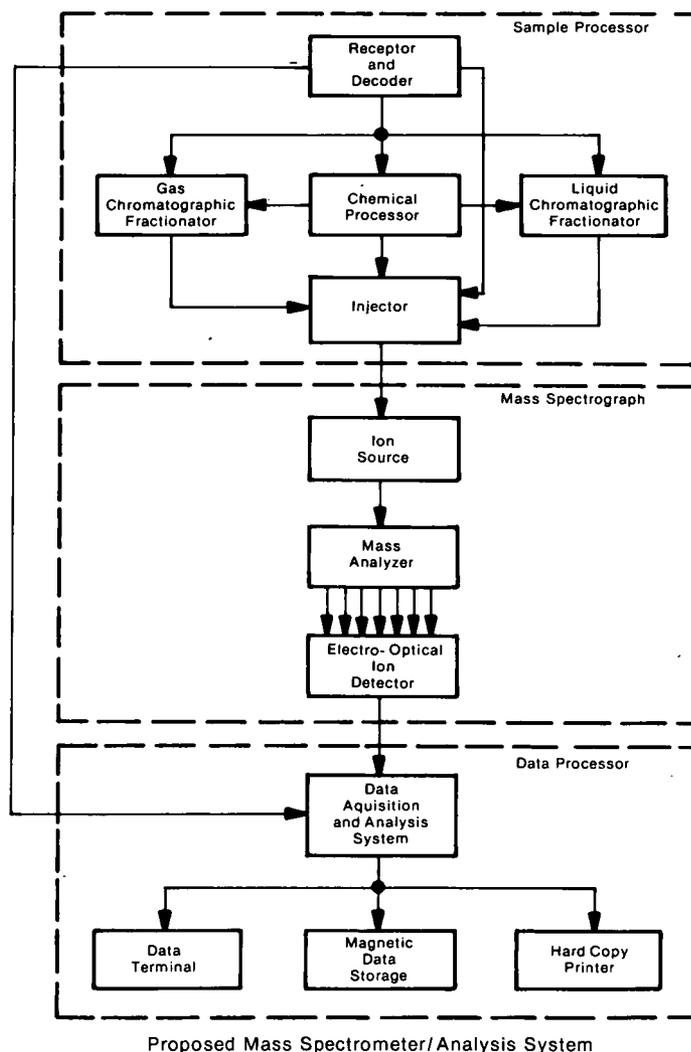


NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

## Automated Mass Spectrometer/Analysis System: A Concept

The increased understanding of the molecular origins of health and disease has led to the need for more frequent and more intensive studies of body metabolism. Therefore, the development of methods for the assay of a wide variety of components in

complex biological matrices, such as serum and urine, is of interest to the biomedical researcher and the clinical chemist. Presently, the relatively high cost per analysis and low sample throughput have made such assays, in general, prohibitive for routine work.



Proposed Mass Spectrometer/Analysis System

(continued overleaf)

A new automated mass spectrometer/analysis system is being designed to perform rapid multiple analyses of entire compound classes or individual compounds on small amounts of sample and reagent. The routine low-cost availability of these assays will allow the screening of large populations for metabolic disorders and the establishment of effective-but-safe levels of therapeutic drugs in body fluids and tissues.

In the analysis system small volumes of volatilizable samples (or their characteristic volatilizable derivatives) are utilized. Each sample is analyzed automatically. The components of each sample and their abundances are determined simultaneously with a high degree of accuracy, with minimum operator attention, and with a high sample-throughput rate.

The proposed system includes the following subsystems, as shown in the illustration: (a) a sample processor, (b) a mass spectrometer, (c) an electro-optical ion detector, and (d) a data processor. The subsystems are controlled by a single control unit which insures proper automatic operation of the entire system. Briefly, the sample processor receives samples to be analyzed in separate identifiable cartridges. The samples are converted into their characteristic volatilizable derivatives. The volatilizable samples are successively volatilized and are injected into the mass spectrometer.

Inside, each sample is first ionized to form an ion beam which is then dispersed into separate ion beams, based on the mass-to-charge ratios of the ions. All the ion beams are focused simultaneously onto a common focal plane. The electro-optical ion detector first converts the ion beams into separate electron beams which are used to produce separate images [NASA Tech Brief B75-10328 (NPO-13524)]. Thereafter the separate images are converted into electrical signals which are supplied to and processed in the data processor. The processor provides a list of identified components of the original sample and their abundances.

The control unit monitors the various voltages and currents supplied to various parts of the subsystems. In addition it protects various parts of some subsystems from becoming oversaturated or damaged due to other-than-normally-expected operating conditions. The unit also controls the transfer of the electrical signals to the data processor. After the electrical signals are transferred and after the sample is determined to be fully ionized, the unit commands another sample to be transferred to the volatilization chamber and then to the mass spectrometer for continued analysis.

**Note:**

Requests for further information may be directed to:

Technology Utilization Officer  
NASA Pasadena Office  
4800 Oak Grove Drive  
Pasadena, California 91103  
Reference: TSP75-10331

**Patent status:**

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

Patent Counsel  
NASA Pasadena Office  
4800 Oak Grove Drive  
Pasadena, California 91103

Source: Heinz G. Boettger, Charles E. Giffin,  
William J. Dreyer, and Aron Kuppermann of  
Caltech/JPL  
(NPO-13572)