# AN ORAL HISTORY ARCHIVAL PROJECT FOR ION MOBILITY SPECTROMETRY: Martin J. Cohen and Franklin GNO Corporation

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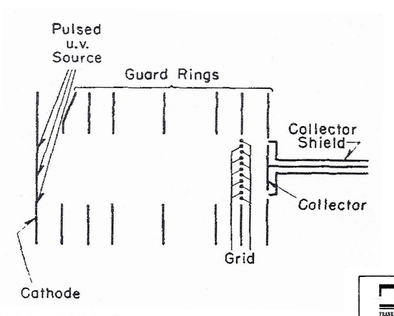
## Summary

An oral history project has been started to document the origins and development of IMS. The first interview was with Dr. M.J. Cohen who also provided a file of documents dating to the mid 1960s. Two primary questions were formulated regarding the beginning of IMS

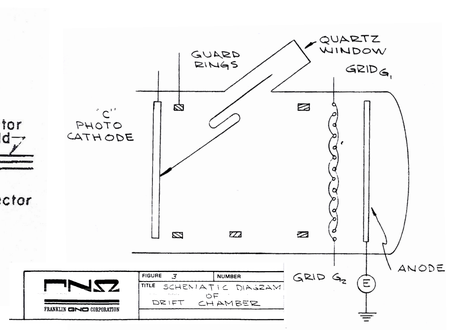
a. What are the origins of modern analytical Ion mobility spectrometry?
b. What was the path of technology development at Franklin GNO that lead to the introduction of the Beta-VI instrument in 1970?

The documents that provided answers to these questions included the patent record, government reports, and newspaper articles.
In the Franklin GNO report of the 1965-1966 project report to NASA entitled "A Fundatmental Study of Elcrtorphilic Gases for Plasma Quenching, a drift tube design based largely on that of M.A. Biondi was referenced. These drift tubes may be considered proto-IMS drift tubes and are shown below., The first question may be substantially answered as modern analytical IMS can be traced to Biondi in 1961.[1,2]

Clues for the second question can be seen in a Palm Beach Post-Times newspaper article (April 16, 1967) entitled "People Sniffer Should Be Better Than Bed Bugs" where the development by Franklin GNO of IMS is described for detecting Viet Cong in the jungles of Vietnam.




1961-1962. Biondi , et al. Determination of electron attachment to oxygen with photo-emissive surface as electron source.




Oct1965 to Oct 1966. Experimental apparatus; proto-IMS drift tube in glass vacuum chamber at Franklin GNO

NASA CR-66206

A FUNDAMENTAL STUDY OF ELECTROPHILIC GASES

FOR PLASMA QUENCHING

BY

Robert W. Crowe
and
W. D. Kilpatrick

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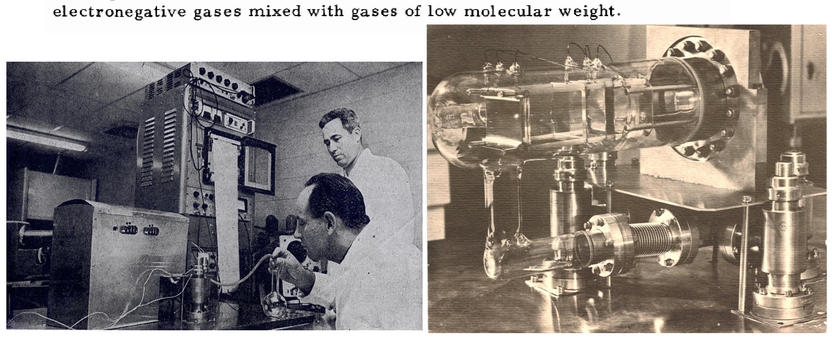
For:
National Aeronautics and Space Administration
Langley Research Center

As a result of our own research on the behavior of the electronegative gases, as well as an examination of recent investigations dealing with electron attachment processes, we have developed an instrument which employs these phenomena for the detection and examination of the physical properties of negative ions produced by high molecular weight perfluorocarbon materials mixed with air. This instrument is, in many respects, analogous to that used by Chanin, Phelps and Biondi[3] in their measurements of electron capture of $0_2$ molecules. It does, however, differ in one important respect which will be described in detail in the sections which follow. In this report we describe the experimental method and demonstrate its feasibility as a technique for the examination of electron attachment characteristics by electronegative gases mixed with gases of low molecular weight.



1967 Dr. Cohen and colleague from newspaper article "People Sniffer Should Be Better Than Bedbugs" with an IMS (above left) based on a drift tube (above right) in glass chamber, from undated company brochure. The glass chamber instrument is found in a 1965 report on Office of Naval Research contract.[4]

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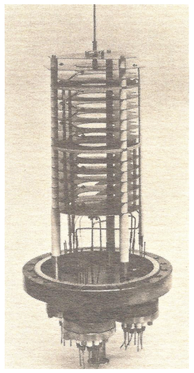
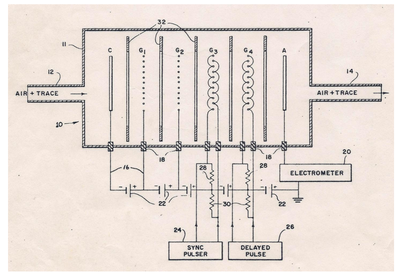
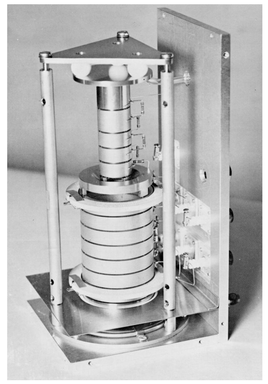
|---|---|---|---|
| Experimental Investigation of Electron Attachment Characteristics of Certain Materials in Atmospheric Air *Studies on dimethylhydrogenphosphite, triethylphospate, and Sarin with a pulsed D2 lamp at 50-100 torr in negative polarity. The drift tube was in a glass chamber.* | Nonr-4977(00) | Office of Naval Research | May 1965 March 1967 |
| Performance Study of the PC* Marking System *Study for personnel detection and chemicals for tracking and marking. This was the first all metal stainless steel drift tube equipped with 250 µs shutter pulses. Two shutter coplanar design with continuous UV lamp.* | FO8635-67-C-0075 | Air Force Armament Laboratory, Eglin Air Force Base | April 1967 June 1968 |
| PC Experimentation with Already Available PC Instrument: Design, Construct, and Laboratory Evaluate Modular Prototype PC* *New drift tube with wide rings, high temperature operation (200°C), vibration rugged. Operated in truck and helicopter from batteries or generator.* | DAADO5-69-C-0139 | Land Warfare Laboratory, Aberdeen Proving Ground, US Army | Nov 1968 May 1970 |

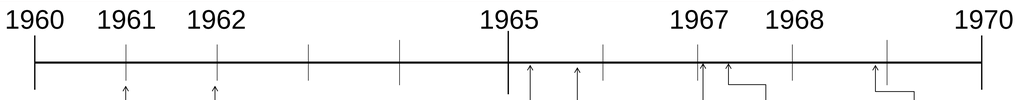




Drift tube (above left) taken from undated company brochure (ca. 1965 to 67) showing complete dual shutter drift tube for analytical IMS. Drawing of similar drift tube (above center) from 1972 patent (*Apparatus and Methods for Separating, Concentrating, Detecting and Measuring Trace Gases)*, and drift tube (above right) from Beta VI, the first commercial IMS instrument from 1969-1970.

## Timeline




1961, 1962
Biondi articles on electron attachment with drift tube,

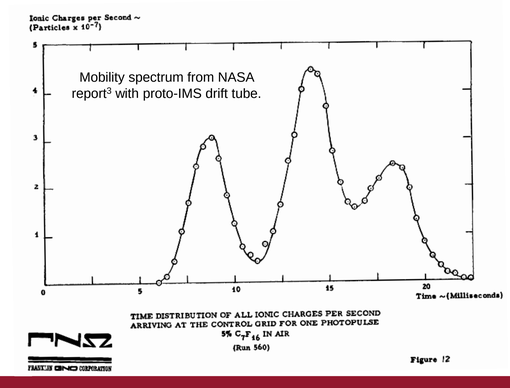
May 1965
Office of Naval Research contracts with Franklin GNO—studies use glass chamber drift tube

Oct 15, 1965
Project for NASA at Franklin GNO using Proto-IMS drift tube

1967
NASA report from Franklin GNO, *A Fundamental Study of Electrophilic Gases for Plasma Quenching*, by R.W. Crowe and W.D. Kilpatrick

April 16, 1967
Air Force Armament Laboratory contract and Palm Beach Post article re: "*People Sniffer*"

November 1968
Aberdeen Proving Ground contract




Mobility spectrum from NASA report[3] with proto-IMS drift tube.

## Conclusions

Technology for modern analytical IMS developed from ion drift experiments for studies on electron attachment to oxygen with a pulsed electron source. This proto-IMS drift tube was modified ca. 1967 to a second ion shutter, an ion source for use in air at ambient pressure. A change in drift tube design between 1967 to 1969 resulted in a commercial design, the Beta VI instrument from Franklin GNO, later PCP, Inc.

## References

1. M.A. Biondi, *Measurements of Electron Attachment, Recombination, Elastic and Inelastic Collisions in Atmospheric Gases*, Planetary and Space Science (1961) v.3, pg.104-112
2. L. M. Chanin, A. V. Phelps, and M. A. Biondi, *Measurements of the Attachment of Low-Energy Electrons to Oxygen Molecules*, Phys. Rev. (1962) v.128, pg. 219–230
3. R.W. Crowe and W.D. Kilpatrick, A Fundamental Study of Electrophilic Gases for Plasma Quenching, NASA report CR-66206, 1967
4. G.A. Eiceman, Z. Karpas, Ion Mobility Spectrometry, 2nd Edition, CRC Press, Boca Raton, FL, 2004, Chapter 1.