# COMPARISON OF PARTIAL-PRESSURE ANALYZERS

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We have investigated three different gas analyzers in the course of our work at Langley - the omegatron, the 90° magnetic sector with electron multiplier, and the time of flight. I would like to discuss briefly some of the advantages and disadvantages of each.

The omegatron in the past has been used primarily in the pressure range around $10^{-6}$ to $10^{-7}$ torr. There seemed to be no reason that the instrument could not be used in the ultrahigh vacuum range and so we investigated the operating characteristics of the omegatron in the ultrahigh vacuum range and the results of the investigation are being published in NASA TN 4242. Briefly, the omegatron is usable down to about $2 \times 10^{-11}$ torr but has a limited mass range. Since it has no electron multiplier, the output of the omegatron is very reproducible and the instrument is an excellent quantitative analyzer. The analyzer tube of the omegatron is simply constructed so the instrument can be cleaned well enough to eliminate its self-spectrum.

The 90° magnetic sector type partial-pressure analyzer will measure very low partial pressures, $10^{-12}$ or $10^{-13}$ torr, and with an electromagnet has an acceptable mass range. In our use, however, we encountered two main problems. The first problem was that we were not able to clean the instrument sufficiently even after weeks of baking and electron bombarding. The second problem was that the sensitivity of the instrument shifted after baking. Because of this change in the sensitivity it is difficult to use the instrument as a quantitative analyzer. The analyzer tube that we used was not nude, by the way, and a nude analyzer may help with the first problem.

The time of flight mass spectrometer will measure partial pressures to $10^{-13}$ torr and has separation of adjacent peaks at mass 200. The main advantage of this instrument is its flexibility. Its various capabilities are too numerous to go into here but it can be used in many useful modes of operation. We have used the instrument primarily as a partial-pressure analyzer utilizing a nude flight tube that we have installed in a 20-cubic-foot ultrahigh vacuum chamber. Figure 1 shows the nude flight tube installed in the chamber along with a sample of solid-rocket-propellant fuel that we were investigating. You can see that the analyzer section of the mass spectrometer protrudes through the port in the far door and is in close proximity with the sample under investigation. We feel that it is very advantageous to have a nude analyzer tube when trying to measure partial pressures in the ultrahigh vacuum range. The main disadvantage of the time of flight is probably the fact that there are so many "black boxes" that can develop electronic troubles.

We have found that the time flight mass spectrometer gives us the best all-around capabilities for partial-pressure analysis.

# EXPERIMENTAL SET-UP

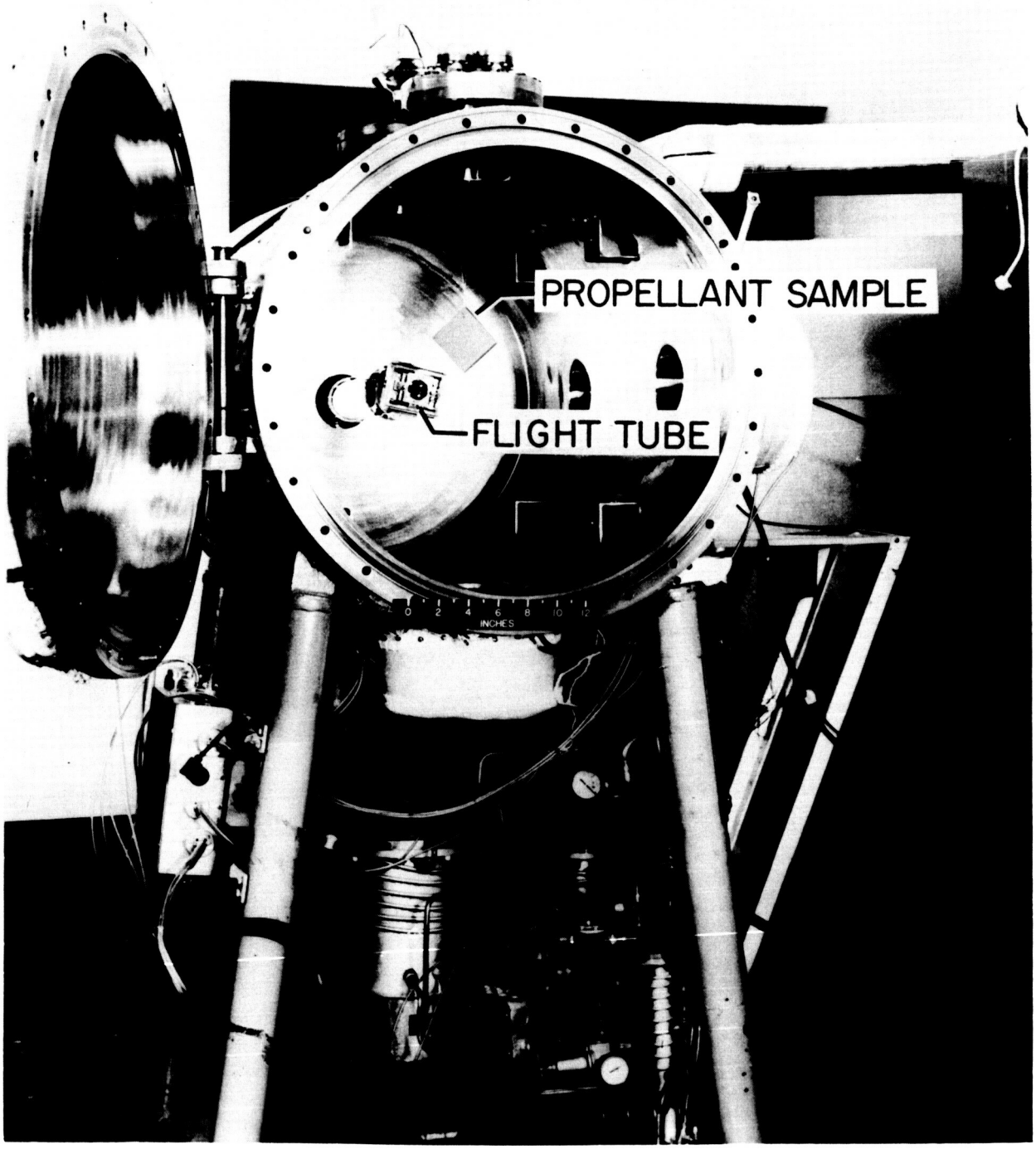


Figure 1