Pressure and Temperature Measurements in the Upper Atmosphere

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November 29, 1946

THE October 10 V-2 firing at White Sands, New Mexico, gave interesting atmospheric pressure data in the region from 50 to 90 km above sea level.

The nose-tip of this rocket was made in the form of a cone of 13° apex angle. A ring of holes around the cone afforded connection between the exterior surface and the interior instrument compartment. Additional pressure measurements were made at a point near the tail of the rocket. Experiments by Taylor and Maccoll[1] show that the pressure on the side of a 13° nose cone should be about 1.8 times ambient when the rocket velocity is about 1 mile per second. German wind-tunnel measurements indicate that the tail section gauges should read ambient pressure to within about 10 percent.

Two different types of gauges gave usable data, their readings being transmitted by radio to a telemetering ground station.[2]

Pressures in the lower atmosphere were measured by a sylphon bellows gauge at the tail position. Bellows displacement was transformed into shaft-rotation of a Microtorque potentiometer. This gauge was designed to cover the range from 760 to 15 mm Hg, but broke at a pressure of 150 mm evidently from vibration. Figure 1 A shows the correlation with data computed from Weather Bureau temperature measurements taken over El Paso, Texas, (80 miles distant) at 8:00 A.M. the morning of the flight. Note the deviation when the rocket reached the speed of sound (Mach number =1).

Tungsten wire Pirani gauges in nose and tail gave satisfactory data. These consisted of 6-watt, 110-volt Mazda pilot lamps with a hole in the bulb tip. The tail gauge measurements are plotted in Fig. 1B. The points determined from the nose gauge lie almost exactly on the same curve. The twofold increase in pressure predicted by Taylor and Maccoll is absent. The discrepancy is unexplained to date, and is most surprising, since on the one hand, some pressure build-up can be predicted from elementary considerations, while on the other hand, a factor of 2 difference in gauge performance is hard to believe. Further studies should clarify the matter.

For comparison with the present observations NACA atmospheric pressure values based on assumed standard temperature[3] are shown by the dashed line in Fig. 1B. The good agreement obtained confirms the essential validity of the assumptions underlying the NACA curve, which is based entirely on indirect evidence. The bend in the solid curve between 60 and 80 km confirms the existence of the negative temperature gradient predicted by the NACA.

Because of the high V-2 velocity and the rapid rate of change of pressure with altitude, it was possible to fix within ±2 sec. the time of maximum altitude by noting the times on the ascent and the descent at which the pressure had a certain value; namely, 0.05 mm Hg. From this, a peak altitude of 108±2 miles was computed.

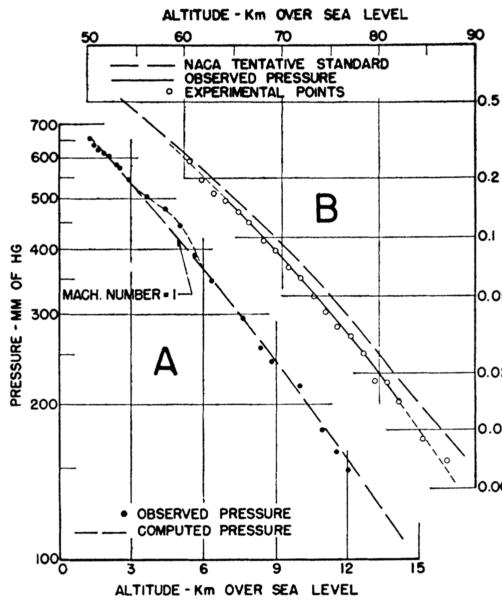

FIG. 1. Pressure measurements in the upper atmosphere. A. Bellows gauge. Use lower and left-hand scales. B. Platinum Pirani gauge. Use upper and right-hand scales.

Eleven platinum resistance and thermistor temperature gauges were installed to measure the adiabatic air temperature and the skin heating. The highest skin temperature observed was 180° C on a 0.3-mm wall section in the control chamber. Further results will not be published at the present time, pending a more complete analysis.

[1] G. I. Taylor and J. W. Maccoll, Proc. Roy Soc. **139**, 278 (1933).
[2] Naval Research Laboratory Report R-2955, Chapter II, Section C, (October 1, 1946).
[3] National Advisory Committee for Aeronautics, *Tentative Tables for the Properties of the Upper Atmosphere* (Prepared by Calvin N. Warfield), Table III—(Sept. 1946).

On the Disintegration Scheme of Na^{24}

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December 1, 1946

WHAT appear to be the most reliable measurements on the disintegration of Na^{24} suggest a simple beta-particle spectrum with an end point of 1.39 Mev and two gamma-rays of about equal intensity with energies of 1.38 Mev and 2.76 Mev.[1]

Experiments on the inelastic scattering of protons and neutrons[2] by the Mg nucleus indicate excited levels at 1.3 Mev, 2.74 Mev, and 3.88 Mev.

The existence of γ-γ coincidences[3] and the fact that their intensities are equal suggests that the 2.76-Mev and 1.38-Mev rays are in cascade. However, Sachs[4] in a recent letter, has called attention to the fact that such a level system would yield a mass for Na^{24} which would be in disagreement with the value predicted by Barkas.[5] He has, therefore, proposed an alternative scheme, whereby the 1.39