

Stratosphere Flight in the Balloon "Explorer".*

GAY-LUSSAC was probably the first scientist to go up in 1804 into the earth's atmosphere in a hydrogen-filled balloon to obtain accurate knowledge of it *in situ*. Since then there have been, at various times, a number of balloon flights; some have been successful, but others have ended in tragedy and death.

But the spectacular and successful flight in 1931 of Auguste Piccard, the pioneer of balloon ascensions, in a sealed metal gondola, became the forerunner of the subsequent series of balloon flights in Russia, Belgium and the U.S.A.

The publication under review gives, in a series of articles, the details of the flight into the stratosphere of the giant balloon *Explorer* on 28th July, 1934. This expedition was organised jointly by the National Geographic Society and the Army Air Corps of the U.S.A. and is a wonderful example of co-operative effort in the cause of science by a large number of scientists and private and public organisations and individuals.

The object was to collect accurate information about the variations with height of temperature, pressure and humidity, wind velocity, compositions of air, the ozone layer, the directional intensity of cosmic rays, altitude measurements, colour of sky, etc.

The large number and variety of specially designed, highly intricate instruments and associated equipment were all arranged suitably in a sealed magnesium alloy (Dowmetal) spherical gondola, 9 feet in diameter, till it was really a densely packed, multi-purpose, floating laboratory with its own radio telephone (transmitting and receiving) equipment for continuous communication with the earth below.

To lift this great weight with three men inside to a height of some 75,000 feet above sea, the balloon was designed to have the gigantic volume of about 3,000,000 cubic feet, standing some 300 feet when partially inflated and changing into a spherical shape of 180 feet diameter high up. The covering was of rubberised cotton fabric and entirely without a single stitch over its whole area of over 11,000 square yards.

The various beautifully illustrated technical papers on the design, construction and operation of the balloon, gondola, cosmic ray apparatus, spectrographs, barometers, cameras, etc., by outstanding men like Millikan, Swann, Briggs and others are most interesting and instructive to read even for the lay reader. Every detail of every piece of apparatus and mechanism was worked out with meticulous care and precision to secure maximum safety for the fliers and the balloon, and the smooth and efficient working of everything over the extremely varying physical conditions during the flight.

Despite all this, and of the fact that the three fliers were outstanding airmen, the great balloon started to give way at 11 miles above earth and ended in disaster for the balloon, the gondola and all the many beautiful apparatus inside it. Only the fliers saved themselves by jumping out with their parachutes.

It is impossible to withhold admiration for the great composure and utter disregard of personal safety shown by the heroic fliers over the prolonged period of over two hours from the moment when they first noticed the rent in the balloon fabric when at a height of 57,000 feet. Fully realising the extreme and instantaneous hazard to life at any moment, they attended to their respective duties throughout with a cool courage and devotion to work that are beyond praise.

Highly interesting as are the technical articles, no reader, lay or learned, can read unmoved the graphic story of the flight by Captain Stevens and the shorter report by Major Kepner. The numerous excellent photographs help to give a strikingly vivid picture of the various stages of the flight.

Not the least remarkable feature of the expedition was the part played by radio. From the beginning to the last moment when the fliers jumped out of the detached gondola hurling down to the earth, there was perfect two-way radio telephone communication between the gondola and the earth. The millions of listeners throughout the United States followed from minute to minute the thrilling events of the flight and the last minute escape of the airmen.

Of the results of the expedition, the publication does not say very much as, with the gondola, all the valuable records with the exception of a few were destroyed.

All the observations show that the *Explorer* reached a maximum altitude of a little over 62,000 feet. Altitudes by the barometric formula and the vertical camera photographs agree with each other remarkably well (page 23). Wind velocity varied from a value of 70 miles per hour at 42,000 feet blowing from north-west to 28 miles at 50,310 feet and in the same direction; but at about 60,000 feet, it dropped to 10 miles per hour and in the opposite direction, blowing from south-east.

Temperature fell with height in proportion to the logarithm of the pressure upto about 150 mm. of mercury (page 21); with a reduced rate of fall, a minimum temperature of -62°C . was reached at the height corresponding to 75 mm. of mercury. Further up, a rise in temperature occurred.

Cosmic rays increased in intensity with height and with inclination to the horizontal (pages 12, 13, 423).

Altogether a very readable account of an excellently planned daring enterprise which deserved better luck. It will be with no small interest that the report of the recent successful flight of *Explorer II* will be expected.

* The National Geographic Society—U. S. Army Air Corps *Stratospheric Flight of 1934 in the Balloon 'Explorer'*; Published by the National Geographic Society, 1935.