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INVESTIGATORS OF THE STRATOSPHERE

Flights of Meteorological Rockets

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INVESTIGATORS OF THE STRATOSPHERE

Flights of Meteorological Rockets

A column of bright flames shot up skywards, spreading a fiery reflection on the surrounding snow and ice. Somehow this column of flame resembled the tail of a firebird from a fairy tale. A second later a huge missile raises towards the sky discharging flames. It is visible even with the naked eye that the speed of the missile increases from second to second, cutting through the skyline and disappearing in the unknown realms above. The flight of the rocket is being observed not only by people from the safety of a small building located at the edge of the Arctic island, but also by many instruments. This was the launching of a consecutive meteorological rocket from Heiss Island which is located almost in the center of the Franz Joseph Archipelago.

These rockets were much smaller than the geophysical rockets. They do not carry live passengers, and they do not reach the cosmic space. The assignment of these rockets is also much simpler, their purpose is to reach an altitude of 80 to 90 km, transmitting information about temperature and pressure; and somewhere at the upper limits of the stratosphere the head section separates and returns to Earth.

The ascent of the rocket continues for several minutes. During that period of time the radio of the rocket continuously transmits signals from its detectors to stations on Earth. These signals are recorded on a magnetic tape. The decoding of these signals will last

for many, many hours. During its ascent the rocket heats up due to friction, and this is reflected on the readings of all its instruments

The return trip is more complicated. In the beginning the parachute does not slow down the nose cone's descent, it only directs the flight. The air is too thin to fill the parachute. Only at an altitude of 60 km does the parachute begin to fill up with air. The "free drop" ends, and a normal descent takes over. It will take almost an hour for the head section of the rocket to return to Earth. But already people on skis are rushing to the landing place. Finally the parachute hits the snow.

The investigation of the stratosphere with the help of meteorological rockets has considerably broadened during the period of the IGY. In accordance with the International Program 125 rockets were launched from Heiss Island (which is located at the 80th parallel), in the middle latitudes of the U.S.S.R., and from aboard the Soviet diesel-electric ship "Ob", which was sailing in the southern polar waters.

At this time the launching of meteorological rockets for the purpose of scientific research continues in accordance with International Geophysical cooperation.

What new information did meteorological rockets contribute to our knowledge about the aerial cover of the Earth? Of what scientific and practical value are the data accumulated with the help of these rockets? We have directed these questions to the main administration of the hydrometeorological service of the Cabinet of Ministers of the U.S.S.R.

We must agree on one point: scientists are still in the dark as far as the age-old problem of rotation is concerned. Let's not forget that the penetration of these depths began a comparatively long time ago. Each rocket flight yields new data. Occasionally it is possible to verify one or another hypothesis, but in general there is still very little accumulated data available. Yet, some mysteries have already been unveiled by human beings.

It is known that the atmosphere extends to hundreds of kilometers from the surface of the Earth. But of special interest is the so-called "domain of meteorology" which is the layer between the surface of the Earth and an altitude of 80 to 90 km. In this layer is concentrated more than 95% of the entire mass of the atmosphere. Here the air layers still preserve a relative density. Above that altitude the air becomes much thinner. This is the region of the ionosphere, the region of complex interatomic and intermoleculer processes.

The shifting of air masses, the distribution of density, and temperature in the layer up to an altitude of 80 to 90 km have a direct influence on the daily activities of people on the Earth. In this region of the aerial sea is formed the weather of the Earth. Airplanes fly at this altitude, and in the near future the greatest difficulties will be encountered here by cosmic ships on their return from space travels. Of great importance is the fact that this same atmospheric layer protects human beings as well as all living matter on the Earth from destructive shortwave solar radiation and its rigid ultra-violet and X-rays.

After ten years of rocket research it was definitely established that the contents of air in its entire thickness up to the lower

limits of the ionosphere is the same as near the surface of the Earth. More than 99% of its contents is nitrogen and oxygen. Only in millionths of a part of a percent can the presence of ozone in air be measured. Nevertheless this ozone absorbs the harmful solar radiations.

The temperature regime was clearly determined. Air temperatures decrease by 6 to 6.5° with each kilometer of ascent in our temperate latitudes up to an altitude of 10 to 11 km (this is the lower part of the atmosphere, the so-called troposphere). Next, up to an altitude of 35 km the temperature changes very little. Then, beginning with a 35-km altitude, the temperature increases, reaching a maximum near zero degrees at an altitude of about 50 km. Above 50 km and up to the upper limits of the stratosphere, the temperature drops again, and at an altitude of 80 to 90 km it reaches an average of 60°, and sometimes even down to 90°, below zero. This is the cold of the cosmos.

From the discoveries of recent years the most interesting fact is that seasonal changes of the "climate" of the stratosphere were established. It was proven that the stratosphere has its winters and springs, its summers and falls. Geographical and latitudinal peculiarities, as well as the distribution of temperature and pressure, were also disclosed. These phenomena appear more clearly with the increase of distance from the equator towards the north or south. That means that at high altitudes an equatorial zone exists as well as temperate latitudes and polar regions. All this has a great influence on the weather conditions in the near-Earth layer.

Not so long ago, it was considered that the invasion of aerial masses of (polar and tropical) cyclones and anti-cyclones took place only in the troposphere, at fairly low altitudes above the surface of the Earth. It is now known that these phenomena affect a considerable part of the stratosphere and cause a movement of gigantic masses of air. The climate of the continents, as well as the influence of the oceans, extends to high altitudes.

By far, not all that scientists have learned is as yet clearly explained in physical terms. The entire mechanism of correlation of aerial masses located in the depths of the atmosphere is not clear yet. The investigation of the stratosphere continues.

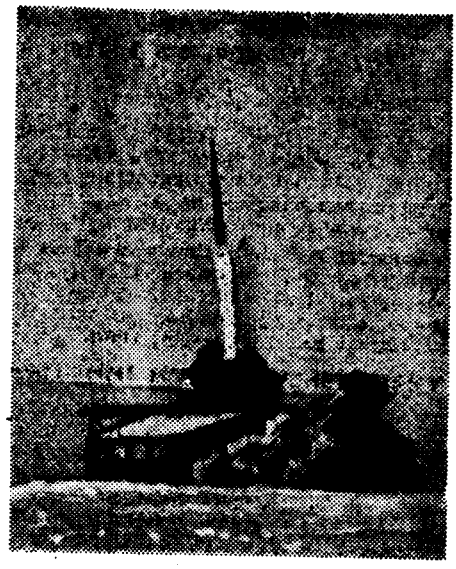

Fig. 1. Launching of Meteorological Rocket on Heiss Island

Fig. 2. Recovery of Rocket's Nose Cone in the Arctic