

PHOTOGRAMMETRIC SURVEY FLIGHTS OF THE GERMAN ANTARCTIC EXPEDITION 1938/39

by

HIGHER GOVERNMENT ADVISER, CAPTAIN ALFRED RITSCHER,
LEADER OF THE EXPEDITION.

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One of the tasks set to the German Antarctic Expedition was to undertake reconnaissances in the interior of the Antarctic Continent and to make a photographic survey of the area, so as to allow the compilation, by means of photograms, of a chart of the region extending between meridians 20 West and 20 East, in which the expedition was to carry out its operations.

The members of the Deutsche Gesellschaft für Photogrammetrie were able to avail themselves not only of the work done in a similar region by Richard Byrd in 1928/30 and Lincoln Ellsworth in 1933/34 and in 1935/36 as well as of the flights made along the antarctic coasts by the Norwegian Consul Lars Christensen's exploring expedition, but also of the excellent lectures given in May 1938 before the Lilienthalgesellschaft on "the use of aircraft for exploring polar regions" by its Director, Dozent Adolf Hoel. These referred chiefly to aerial surveys by strips, whilst in the case of the 1938/39 Antarctic expedition we had to endeavour to obtain a closer aerial survey. Our special effort was to draw up a rough chart leaving out all useless accurate details and to work fast enough to make it possible for the survey to be carried out in harmony with the cartographic method. The final result was a chart of New Swabia described in this article and the next.

The ship, aircraft and cameras had been very carefully selected with a view to the work to be carried out. The motor ship "Schwabenland" belonging to the Deutsche Luftansa, which was fitted with a catapult and which up to then had chiefly been engaged in tropical voyages was used for carrying aircraft. In order to perform this new service, the ship had to be fitted with a protection belt against ice pressure, which meant that her bows had to be reinforced and her normal outer sheathing replaced by one twice as strong. For extra safety, the empty spaces under the watertight lower deck were filled with several thousand new iron barrels capable of keeping the ship afloat, even if two intermediate spaces were knocked in and filled with water.

The selected aircraft were two ten-ton Dormer-Wales. These are seaplanes of a type which has proved its worth during many years of transoceanic service and can be shot off by catapult. The advantage of using an aeroplane that can be shot off when the nature of the work to be carried out involves over loading is to do away with the difficulty of its taking off from the water. The seaplanes, once ready for taking off, no longer weighed 10 tons, but 10 tons, 7; for, apart from the two heavy repeating cameras, they had to carry all the material necessary for long distance flights, one month's rations for a crew of 4, sledges, skis, tents, cooking utensils, arms, ammunitions and a complete outfit of furs in case of landing.

Two R M K C/5 repeating cameras manufactured by the Zeiss-Aerotopograph firm were selected. Their practical installation on board the planes caused a great deal of trouble to the two aircraft camera engineers of the Hansa Luftbild G, m, b, H., Bundermann and Sauter.

The cameras could take 18 × 18 square centimeters pictures with an over lap of 60%. 60 reels of films each 60 meters long were also provided for.

The expedition left Hamburg on December 17th and 35 days later, on January 19th reached the edge of the ice-pack surrounding the antarctic continent. A trial flight was effected on January 19th and proved the engines and cameras of the seaplanes to be in good working order. As soon as the ship had succeeded in winding her way through the ice-pack up to $4^{\circ} 1/2$ West on a length of 100 kilometers, a first long distance flight towards the pole could take place at 4.40 a.m. on January 20th under very favorable flying conditions.

A flying course scheme had been prepared. The latitude and longitude of the taking off point were accurately determined by astronomic observations, the planes were to fly over a 800 kilometers long rectangle Southward and 30 kilometers Eastward. The scheme provided for corresponding declinations and distances in kilometers; the rectangles were overlapping one another in an East-West direction, each one being 50 kilometers distant from the preceding one. This arrangement was rendered necessary by the installation of repeating cameras. In fact, one of these cameras was fitted on each side of the plane and set with a tilt of 20° on the horizon, so that at an altitude of 3000 meters above the ground, it was possible to obtain with certainty on each side a photograph showing a section of 25 kilometers quite clear with 50 Km. still available for possible use and another 100 Km. still susceptible of interpretation. This arrangement allowed all points of the region to be photographed at least once on each side and, as a rule, two or three times; as the photographs overlapped at 60%, all necessary data were available for the photogrammetric mensuration of the photographed region and a compilation of a chart of the same. This scheme permitted to arrange flights from any point of the coast formed by the insular shelf ice. This was necessary as we did not know how far the ice-pack would allow us to approach the insular shelf ice until we actually tried it.

The arranging of flight courses depended on the cruising radius of the planes and the above mentioned range of the photographic cameras. Thus, for each flight, an area of at least 60.000 square Km. could be photographed, if the side camera range were utilized up to 25 Km. only; but if the whole range of 100 Km. were taken into account, an area, about three times wider, would be covered by photography. Of course we realized that this optimal result could hardly be achieved, as a steep ascending slope was to be reckoned with in the direction of the pole and the ceiling of the planes could hardly exceed 4000 m. above the sea.

We closely and eagerly watched the plane as it disappeared for the first time into the clear icy cold atmosphere. But as our close watch diminished, our eagerness became greater under the impression caused by the wireless messages which we received every quarter of an hour which went even beyond our hopes. They showed that we were dealing with an extraordinarily interesting region. The flat insular shelf ice extended up to 50 Km. towards the land; then came a gently rising white green and blue glacier, with a generally smooth surface over which roaring passing storms had only left a thin layer of hardened snow. Rocks stood on the glacier, first isolated and then in large numbers, they were partly indented partly rounded off by wear and tear. Further, towards the interior, mountains and mountain ranges were found. South of these ranges appeared the Wegener-inlandsis, bare and slightly arched, rising up to a height of 4300 meters behind a steep rocky wall, it sloped down fairly regularly and almost without a break west of the whole of mountain ranges towards the insular shelf ice.

At the same time, towards the East and separated from the mountains that stretch beyond by the Penck glacier basin, a mountain range, with an occasional width of 100 Km. extended as far as the eye could reach.

We felt certain that we had to take in all this with our cameras, and considering that westward, with the exception of a few isolated heights, there was only a prospect of a bare glacier, our exploration had to be carried out eastward.

The first three flights which lasted from 8 to 10 hours were successfully accomplished in accordance with the scheme, during the first three days. Then, some threatening clouds spread over the continent; they rolled round the mountains of the east and south, and veiled the ridges of the sharp edged rocks and the steep peaks almost down to the bottom. We had so far photographed all of a piece 140.000 square Km. of the great 250.000 square Km. region to be explored; but there were still further East mighty masses of mountains with their slender tower-like tops and sharp jagged rocky ridges that stood at considerable heights. We had to wait until the weather cleared up before we could start to photograph them.

As regards weather forecasts, the only information we had available was that kindly sent off by wireless by the whalers operating N.N.W. one thousand miles away and at the same distance from the East as we were. Though such information proved to be very useful to assist the aircraft meteorologist, he had still to base his westward forecasts on his own devices with ascending pilot balloons and his own experience. After six days he could give us some hope of a transient improvement in the weather.

Judging from the flights made and as far as the eye could reach at our flying altitude, there were only bare eastward glaciers between the edge of the insular shelf ice and the mountain ranges, on a distance of 200 to 300 Km. in the interior. It seemed of little use to photograph this glacier owing to the necessity of saving both time and films. But further south and eastward was a mountain range with a width of over 100 Km. in some places. We then proposed and decided to steer directly southwards for this mountain range beyond the space which might be pronounced empty and to fly over and round it by eastward and westward routes, inasmuch as no one could know whether we should still be favoured with a spell of fine weather. The only drawback involved by this change in our programme was some uncertainty in declination. This difficulty and the change of wind were not taken into account among the errors resulting from actual South North flights with values that differed from those of East West flights. We could still hope that the Hansa Luftbild G.m.b.H., that were prepared to undertake the plotting of our photographic data, could get over these difficulties with their great experience.

So that when the clouds passed away on the seventh day after the first flight, we proceeded according to the new plan. Thus, we succeeded later on after a second interruption due to a spell of several days had weather to cover in three hops by seriatim photography the whole of the mountain range extending between 5° West and 20° East, the east end of which is constituted by the 10,000 Km. of the great Wohlthat mass of mountains. This was just done in still suitable weather, because another spell of bad weather seemed to be approaching and there was little hope at that advanced time of year, to be able to proceed with photographic operations once it was over. Besides, symptoms of winter which comes very early in this region were becoming obvious and more and more numerous. At our flying height the temperature went down to 34° C. below zero and to -6° on board ship.

New ice was forming between the ice pack and in the bays of the insular shelf ice, so that there was no object in assuming the responsibility of a more prolonged stay on board an iron ship in this region, especially as great masses of ice floes coming from East and West were approaching. After staying 19 days by the antarctic insular shelf ice, we sailed back on February 6th.

Out of the whole of the great 600,000 square Km. region which was sighted and which now bears the name of New Swabia land, 350,000 square km. of the larger portion were taken by 11,600 successive photographs in seven flights. The outcome of the exploring expedition has been the compilation of a map on the scale of 1 : 500,000 by the Hansa Luftbild G.m.b.H. Although this map which has been severely criticized cannot be considered an accurate reproduction of the photographed topography, being based, as far as points of reference are concerned, only on the taking off positions of the aircraft and as regards heights, on the indications given by the plane barometric altimeters, it represents however an effort, the like of which had never yet been achieved in the antarctic.

