

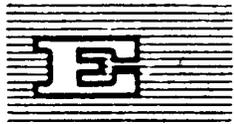
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AERIAL PHOTOGRAPHS AND INTERIM CARTOGRAPHY ON
A 1:1,000,000 SCALE
(Paper submitted by the French Government)

AERIAL PHOTOGRAPHS AND INTERIM CARTOGRAPHY ON A 1:1,000,000 SCALE

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The question of maps on a 1:1,000,000 scale

The normal process of compiling maps on a 1:1,000,000 scale consists essentially in making an appropriate generalization of the most detailed maps, generally called "base maps", which have been prepared in their turn directly from aerial photographs.

At present, for populated areas, or areas presenting features of particular interest, the base map has generally been completed. It is prepared on scales varying between 1:20,000 and 1:200,000 according to the importance of the area. The production of a map on a 1:1,000,000 scale is then very simple.

In desert areas, on the other hand, the base map produced from photographs is generally rudimentary. In the Sahara, until very recent years, that was certainly the case.

In order to compile a new map on the 1:1,000,000 scale of the ICAO type, it would in most cases have been necessary to use as a base the only existing document, which was the reconnaissance map known as "Croquis de l'Afrique au 1/1 M." ("Sketch-map of Africa on a 1:1,000,000 scale"). This map, the preparation of which was geared to the camel's gait, was particularly deserving of praise when the extent of the difficulties, the special conditions of the survey and the incredible inadequacy of the means employed are considered.

This map was still very incomplete when the general photographic coverage of these territories was carried out, beginning in 1950 and at an extremely rapid tempo.

The following paradoxical situation then confronted us: although complete vertical stereoscopic photographic coverage of these areas on a 1:50,000 scale was available, it was impossible to derive any advantage from this for the "Croquis de l'Afrique au 1/1 M.", and consequently for

the ICAO map, without preparing beforehand, for each of the 15 sheets on a 1:1,000,000 scale

either 384 sheets on a 1:50,000 scale

or 94 sheets on a 1:100,000 scale

or 24 sheets on a 1:200,000 scale

which was utterly impracticable within acceptable time-limits, taking into account the programmes already in progress. At present, despite the particularly ample resources deployed in the Sahara, the Institut Géographique National is only undertaking the preparation of about 20 map-sheets on a 1:200,000 scale, that is to say less than one sheet on a 1:1,000,000 scale each year.

Solution adopted

In these circumstances, the most neglected areas run the risk of waiting for a long time still before the regular edition of the map is issued. That is the case, more or less generally, for Africa between the 16th and 26th parallels.

It has thus been decided to produce an "interim" edition by direct utilization on a 1:1,000,000 scale of photographic coverage.

An extremely rapid interpretation of photographs can lead to certain mistakes, but it nevertheless permits the positioning of all the most important details with a precision and an "expressiveness", that satisfy all the essential requirements of the user of a map on this scale.

It must be borne in mind:

- (1) that a provisional remaking of this kind is all the more advantageous in that it is completed more rapidly, from which follows the advantage in direct editing on a 1:1,000,000 scale, omitting any intermediate stage.
- (2) that the anxiety to achieve rapidity leads to no unduly rigorous strictness being exercised in the positioning of the drawing, as in any case it is necessary to content oneself with an astronomic control that is sometimes very approximate, and as the drawing

of details on the 12,000 photographs for the sheet must, of necessity, be scaled down "freehand" in a ratio of 20 to 1, by a simple stroke of the pencil.

- (3) that the primary preoccupation must be that of fidelity to forms, so as to permit identification on the map of the details which are apparent on the photograph, and vice versa. For a map of this description, in addition to the services that it can afford to aerial navigation, must also serve as an informative index for all those prospectors who would today scarcely contemplate doing without photographs and often, indeed, have nothing else.

In order to produce this "interim cartography", it is sufficient for total vertical stereoscopic photographic coverage to be available, and likewise astronomic points spaced out at intervals of 50 to 500 km. and identified on photographs (an astronomic point every 100 km. constitutes a very favourable density).

Method of editing

Positioning of the photographs on the field-sheet

A general index of the photographic coverage must be set up, by utilizing the astronomic points identified on the photographs, and by "positioning" the photographic strip taking these points as reference. In order to do this, a framework of layouts of photographs (shown tinted in figure 1) is prepared between the astronomic points, according to meridians or parallels. Adjustment is made to the optimum extent in these layouts when transferring them on to the field-sheet (on a 1:1,000,000 scale). The intervals between two successive photographs (figure 1) are deemed to be constant in one strip.

The drawing of the surface covered by each photograph (1 out of every 2 is drawn) is facilitated by the use of a window pierced in a transparent mount and calibrated in such a way as to permit guiding the delineation of a square representing, to scale, the surface of the map corresponding to a photograph; for example, a square having sides of 9 mm. for the Sahara, as the photographs have a format of 18 x 18 and a scale of 1:50,000.

In the case of an area that is poor in astronomic points (figure 2), it is necessary to cover long distances in linking up the partial layouts end to end; the intersections of meridian layouts and parallel layouts then form nodal points which serve as compensation in the layouts. When it is necessary to undertake the setting up of layouts that cross several flights, it seems possible, in the case of longitudinal strips placed end to end, to take into account the relative scales of these strips, a study of the areas of overlap permitting all the desired comparisons to be made. In the case of transversal layouts, a calculation of this kind - which would have to be repeated for each photograph - would take a very long time and would probably yield deceptive results; it is thus necessary to be satisfied with applying over-all adjustments, assuming that all photographs are on the same scale.

In the case of an astronomic preparation made after photographs have been taken, the matter is very much simplified, as the points are perfectly identified and favourably situated.

The possibility might occur to some of taking into account the angles of deviation of the photographs or small changes in the direction of flight, but experience has proved that it is not possible thereby to avoid unforeseen divergences appearing. Thus, photographs are considered as being uniformly aimed, except in certain extreme cases. Any necessary adjustments are introduced at the moment of drawing, and are in any case dictated by the necessity of forming a proper join with adjacent strips.

When the framework is in position, the indices are completed without difficulty, with the aid of interpolation grids set up for the differing tempo employed in photographing (figure 1). The index thus obtained is printed on the reverse of the map.

Drawing. In view of the quantity of photographs to be examined, organization is of overriding importance. The photographs are set in relation to the field-sheet. All the manipulations that follow are carried out in the same way that the pages of a book are turned, as each photograph is used several times in the course of the various operations that are necessary:

- (1) setting up of the adjusted index, delineated in pencil directly on the field-sheet.
- (2) summary stereoscopic roughing out of variations in the terrain, which are difficult to identify on isolated photographs.
- (3) provisional drawing of the positioning, strip by strip, transferring the details of the photograph to the interior of the transparent window, which has been placed beforehand in the desired position on the field-sheet, with the aid of the plotting of the index.
- (4) the final drawing joined strip by strip, with the fair copy made in ink.
- (5) search for and transfer of details shown on the old map, such as: wells, tracks, villages, etc. Positioning of the toponymy.

If the scaling-down by 20 to 1 requires a certain degree of training, it should nevertheless be noted that a generalization of this sort, however bold it may be, has the fundamental advantage over the usual succession of cartographic generalizations that it is made "true to nature". In the normal process, the "character" of the ground risks disappearing little by little, whereas in this case the editor can always add at the last moment accents suggested by the direct sight of any abrupt features to be represented.

This is all the more important because, with the intensive utilization of photographs, a new type of medium-scale map has appeared. This type of map is characterized by an excessive proliferation of secondary details, which detracts from its clarity and does not facilitate later generalizations, when these are carried out by draughtsmen who are deprived of the opportunity of seeing the model. Representations that are often confused, and sometimes even of wretched quality, result from this circumstances, to such an extent that it has proved necessary to revert to the photographs in order to improve the generalization on a 1:1,000,000 scale of certain productions that were, however, of the regular 1:200,000 scale.

Levelling. The data involved in levelling remains the same as in documents that have to be remade. The contours of level necessary for plotting the limits of the hypsometric tints of the ICAO map are simply adapted to the new planimetry, or else made to correspond with the new vertical data established.

Variations in the terrain are indicated by local scribing of figurative contours obtained by direct roughing out from the photographs. These figurative contours may, with advantage, be made to stand out by an appropriate relief shading. This is the only way to make apparent major variations in the terrain.

The parallax bar provides valuable indications for measuring the relative contours between two points that are close together, like the top and the foot of a cliff or an escarpment. The value of the base used for taking photographs, which is necessary for the calculation of contours, can be measured on the grid which has been used for the layout of the strip in question, and the scale can be deduced from the relationship between the length of a photographic strip and the corresponding length adopted on the field-sheet. In the case of this map on a 1:1,000,000 scale, however, it is only necessary to determine the magnitude of the contours observed, and simply to adopt a formula corresponding with the average conditions attendant on photographing (format, focal distance, scale, overlap). The contour between two points will be evaluated in accordance with the difference between the parallaxes.

In the case of the great majority of photographs taken by the IGN in the Sahara (format 19 x 19 - focal distance, 125 mm - scale 1:50,000 - overlap, 60 per cent), the contour in metres between two points is virtually equal to 6/7ths of the difference of parallax read in 1/100ths of a millimetre between these two points.

Unidentified details. When it has been impossible to identify on the photographs details shown on the old map, they cannot for that reason be omitted. Their positioning, however, in relation to a background that is now identifiable is uncertain. It is, therefore, expedient to show them in their probable position by a special sign meaning: "horizontal position uncertain".

Productivity

A qualified and trained operator can compile in six months a sheet on a 1:1,000,000 scale, of the ICAO type, of average difficulty (or nearly 300,000 sq. km.).

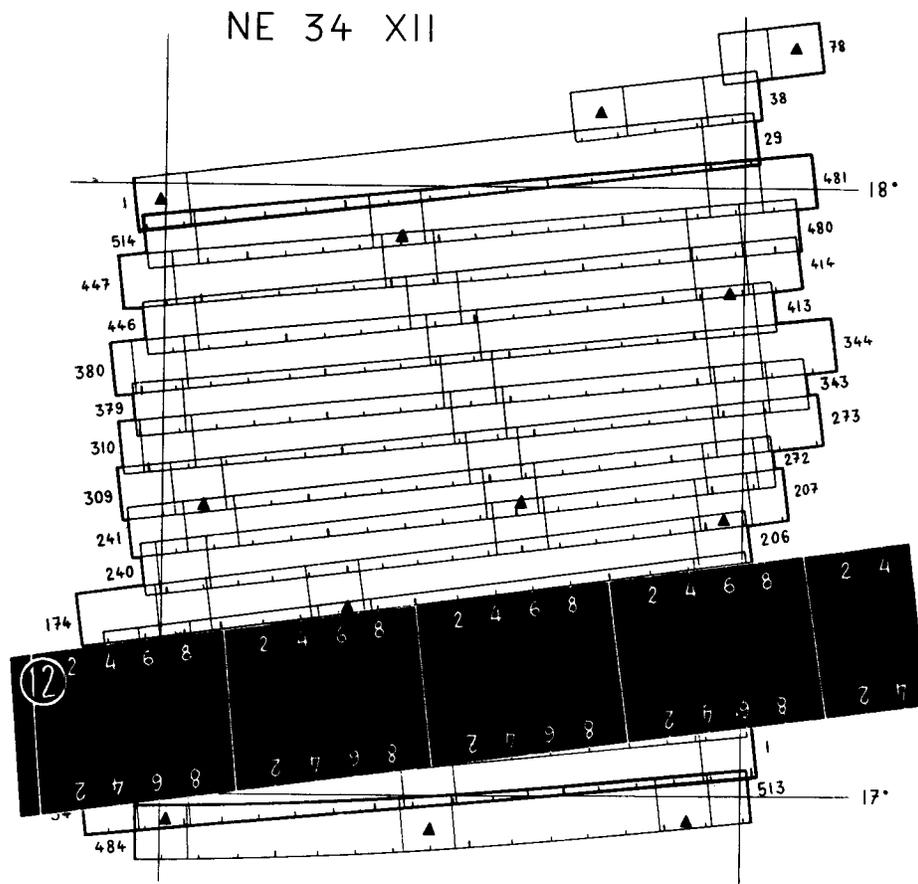
It may be noted that utilization of the photographic coverage of the Sahara has been greatly facilitated by the remarkable regularity of the photographs taken by the Group of squadrons of the IGN.

Conclusion

Maps prepared in this manner constitute a faithful homogeneous, and very expressive document, for aviation in particular. The work can be carried out independently of the normal procedures of map compilation. It allows us to await with less impatience the production of the definitive maps in stages.

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Figure 1 Set up of the index.
Etablissement du tableau d'assemblage.



Layout of meridian and parallel photographic strips of a region for which astronomic points are poorly distributed.

Figure 2

Montage de bandes photographiques méridiennes et parallèles dans une région pauvre en points astronomiques.

- astronomic points used for the layout.
- points astronomiques utilisés pour le montage.

