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civilised world. Each sheet of the air-map will cover an area of 1° in longitude by 1° in latitude. Twenty-four sheets of the same map will cover the same area as one of the sheets of the international map on the scale of 1 to 1,000,000, since each of the latter covers 6° in longitude by 4° in latitude. In order to avoid the troublesome distinction between eastern and western longitudes, northern and southern latitudes, with the inevitable errors caused by the change of sign, the longitudes are to be reckoned from 0° to 360° , in an easterly direction, extending from longitude 180° E. or W. of Greenwich. In addition, there will be given, instead of latitudes, *polar distances*, reckoned from 0° to 180° , extending from the South Pole, in order that, in the northern hemisphere, where lie most of the inhabited lands, the numbers may increase in the customary way with increasing distance from the equator. Each sheet will be numbered by the co-ordinates of its South-Western corner. In addition, marks, each of which is the distinguishing figure of half a rectangle, with the small sides duly set towards North, should be drawn on the roofs of convenient buildings or on the ground itself. Each of these marks indicates the northern or southern half respectively of the corresponding sheet of the aeronautical map. On each mark a large dot will indicate the proper position occupied on the sheet itself by the mark on the ground. Moreover, two large figures will be marked on each side of the rectangle, set towards North; the left one of which showing the number of the units of degrees of the latitude of the mark, and the right one the number of the units of degrees of the longitude. A mistake of 10° , say 400 miles in the direction of the parallels or 700 miles in that of the meridians, being scarcely probable, these two figures will suffice to define the number of the corresponding sheet of the map and the rough co-ordinates of the mark.

If the example thus given by France should be followed by other countries, an international agreement would be necessary to fix positively the conventional signs of the aeronautical map and other particulars.

2. Aeronautical Maps. By Captain H. G. LYONS, F.R.S.

Cartographers must now treat the material at their disposal so as to meet the requirements of aerial navigation, as well as those of travellers by land and by sea, and for this purpose they need the assistance of those who possess practical experience of this new means of transport. Considerations of economy urge that existing scales should be utilised if practicable with such modifications in the information included in the maps as may be desirable. National and international committees are approaching a common basis of agreement on such points as projection to be employed, scale to be adopted, and the identification of localities. There remain these important groups of data which offer many points for discussion by the cartographer and the aviator.

(i) The relief of the land surface must be adequately represented, and show both altitude and slope, so that they may be readily recognised.

(ii) The detail forming the body of the map needs careful compilation, so as to show all that is essential, while eliminating all that is of lesser importance sufficiently to provide a map clearly and boldly drawn. Natural features, communications, settlements, and prominent objects may need a treatment somewhat different from that in topographical maps to obtain the best results.

(iii) Special information must be added which is important to aviators to indicate localities where assistance may be obtained, or where especial dangers or facilities are to be met with. The efficient assemblage of all such information to the best advantage is not the work of a draughtsman, but calls for the skilled co-operation of the technical cartographer and the experienced aviator.

3. A Class of Map-projections—retro-azimuthal.

By J. I. CRAIG, M.A., F.R.S.E.

Two conditions are necessary to determine a map-projection. In a wide and useful class, one condition is that every point shall be in its true bearing from a central point. The class of projection now proposed is such that a central

point lies in its true bearing from every other point, which is not the same thing as in zenithal projections, owing to curvature of the earth's surface. This principle has already been applied by the writer,¹ to the construction of a map where Mecca is represented in its true bearing at every point, and this map has been found useful in Egypt and India.

Professor Hammer² has considered a modification such that the back azimuth of every point is given at the centre, while distances from the centre are correct; and Professor Maurer³ had previously considered a map where every point of a central meridian possesses this property of retro-azimuthality. The writer proposes a new projection, which gives both the true bearing of every point at the centre and the true bearing of the centre at every point.

4. A Numerical Estimate of the Errors of various Projections for Atlas Maps.

By A. R. HINKS, M.A.

¹ 'The General Theory of Map-Projections,' by J. I. Craig, Cairo, 1910.
Pet. Mit., 1910, p. 153.

² *Ibid.*, 1911, p. 255.