

# One in a Million

*This article reviews the history of the various maps published at 1 : 1,000,000 in Australia. Mr. W. J. Sear has recently retired from his position as Chief Drafting Officer with the Division of National Mapping, Canberra.*

by W. J. SEAR

The idea of a homogeneous cartographic presentation of the World at one to one million was advanced by Albrecht Penck of the University of Vienna at the Fifth International Geographical Congress held at Berne in 1891. Nurtured at subsequent geographical congresses, the seed germinated, and a number of countries began issuing maps at that scale, though not to any common plan. However, it was not until much later that the Penck scheme really advanced to maturity with the gathering at London in 1909 and at Paris in 1913 of International Conferences for the International Map of the World on the Millionth Scale.

The promulgation of detailed specifications of scale, sheet lines, projection, conventional signs, sheet numbering system, paper size, layout, lettering and reproduction ensured uniformity in interpretation and presentation irrespective of producing agency. The allocation of spheres of mapping responsibility precluded duplication of effort, and the establishment of a Central Bureau provided the organization and the urge to keep the scheme active. Standards generally have been maintained and I.M.W. became the cartographic showpiece of the era between World Wars.

The scheme provides map sheets bounded by meridians and parallels covering six degrees of longitude by four degrees of latitude between 60 degrees north and south latitudes, with provision for longitudinal extension in higher latitudes. Each sheet is identified by the name of an important feature or locality appearing upon it (e.g. Melbourne), and by a code indicating by letter the latitudinal zone in which it is located, with the equator as origin (e.g.  $0^{\circ}$  to  $4^{\circ}$  = A,  $4^{\circ}$  to  $8^{\circ}$  = B

and so on), and by number its longitudinal zone numbered easterly from  $180^{\circ}$ W. as origin (e.g.  $180^{\circ}$ W. to  $174^{\circ}$ W. = 1,  $174^{\circ}$ W. to  $168^{\circ}$ W. = 2, and so on). The prefix S or N indicates the hemisphere south or north of the equator (e.g. SG56, NF40).

The projection was the brainchild of Ch. Lallemand of France, and frequently bears his name. Each sheet map is drawn on Polyconic Projection which has been modified to establish two meridians true to scale in lieu of one, and to represent all meridians as straight lines in lieu of curved lines concave to a straight line central meridian, thus ensuring perfect fit between adjoining sheets. Linear and angular errors of the modified projection are not significant and "are much inferior to those which would arise from hygrometric deformation of the paper on which the map is printed".

Apart from its intrinsic topographic significance, the I.M.W. filled a long-felt need by providing an admirable base for regional geographical studies and planning, and for various kinds of topical maps such as geological, land use, soils, vegetation, population, hydrological, climatological, and the like.

The Commonwealth Government assumed responsibility for the mapping of Australia and its territories. The work was undertaken by its civilian cartographic organization located initially at Melbourne and later at Canberra. The first sheet published in the Australian sphere was Sydney (1926) followed by Bodalla (1927), Melbourne (1929), Canberra (1930), Adelaide (1934), Armidale (1936), Bourke (1937), and Broken Hill (1940), forming a compact block of

nine sheets covering the south-east corner of the continent. The desirability of conforming to the prescribed standards, and the sparsity of reliable and adequate topographical information and control precluded the further extension of the mapping and production ultimately bogged down on the Port Augusta sheet. In keeping with the tempo of the times, very few draftsmen were available for employment simultaneously on the task.

All known sources of information were tapped. The Shire Engineer provided the current story on road location and classification. Populated places were graded on the latest population census figures and positioned generally on the post office as probably being central to the district. The cadastral map provided the bulk of the topographic detail. It was often the case that in the more closely settled areas, the topographic feature (stream, watershed, road, etc.) had been surveyed as a portion or holding boundary, or in its own right, and hence provided reasonably accurate mapping. However, farther afield the position, numerically and in quality of definition, progressively deteriorated. Contour delineation posed a special problem which was never satisfactorily solved due to the prevailing insufficiency of altitude data and to inadequate knowledge on the part of the mapping authority of the physical configuration of the terrain. Spot heights gleaned from all known sources were plotted on county maps, or on other suitable bases, and contours were interpolated therefrom, paying due regard to the mapped drainage system. Accurate and adequate information was available in isolated areas, which did provide some degree of control.

The maps were fairdrawn in composite at double scale on sheets of bristol board with internal joints straddled and stepped as precautionary routine. Hand lettering was used in the drawings and wet plate negatives in the reproduction. Colour separation was effected on the negatives and final corrections and new work engraved at that stage. Lithographic drafting for solids and masking for rulings were executed direct on the machine plate to a key image especially printed down for the purpose. Machine printing was to hairline register and conformed in all respects to the high standards prescribed.

The nine sheets within the Australian

sphere, which were produced and published to the I.M.W. standard specifications, are not being maintained and are now out of stock.

During the war years a number of maps in Queensland and Western Australia was published at 1:1,000,000 on I.M.W. sheet lines in a Special Defence Edition and not for general distribution. Contours were omitted. The presentation generally did not conform to I.M.W. standards and the sheets were not considered as forming part of the World Series.

During the war of 1939-45, and in the immediate post-war years, production of I.M.W. by Subscribing States was definitely on the wane. The transfer in 1953 of the Central Bureau from the Ordnance Survey at Southampton to the United Nations Organization provided the stimulus for renewed interest.

Suggestions for the improvement of the Series were invited from Member States and discussion held at Regional Cartographic Conferences culminating in the U.N. Technical Conference on the International Map of the World on the Millionth Scale held at Bonn, Federal Republic of Germany, during August 1962. Revised specifications were formulated which stress the importance of uniformity and the suitability of content and presentation for its utilization at minimum cost as the base for thematic maps in general, and for the World Aeronautical Chart in particular. Although the existing Lallemand Projection may be retained, it is now recommended that the Lambert Conformal Conic Projection of the World Aeronautical Chart be used as an alternative. The sheet lines and numbering system are to be retained, but greater flexibility is permitted in sheet extension and in paper size. The revision generally has been designed to meet modern methods, techniques and standards of presentation.

In Australia, the requirement for 1:1,000,000 scale aeronautical charts has overriden the production of the I.M.W. Series.

The crash of the aircraft *Kyeema* on Mt. Dandenong on 25th October 1938 with the loss of all passengers and crew was followed by technical investigations which launched the most intensive and ambitious mapping scheme ever undertaken by Commonwealth mapping authorities to that time. It became known as the Australian Aero-

nautical Map. Although the aviation maps of the period were not considered to have contributed to the disaster, the Committee of Enquiry recommended in a supplementary report that improved map cover be provided for air navigation in Australia.

At that time air route strip maps were in common use. Originally published at 8 miles to one inch, they progressed through 10 miles to one inch to one to one million to keep pace with the increasing speed of aircraft. The strip map was of undoubted value and convenience to the pilot operating between the main airports by visual navigation in clear weather, but its map horizon was too limited to cope with adverse conditions. Complete cover by a homogeneous system of sheet maps was then envisaged, all aspects were considered, and specifications were determined at Conferences of Commonwealth aviation and mapping authorities, the first of which was held in Melbourne during April 1939.

The region to be mapped extended from the equator to 44°S and from the Solomons to Singapore. This was later extended to cover the South-west Pacific and South-east Asia operational areas almost up to the portals of Japan itself.

The aviator of the period stood solidly for rhumb line navigation. Hence a unified Mercator scheme was adopted, the equatorial scale being 1:1,000,000. Each sheet covered six degrees of longitude with a range of latitude decreasing with distance from the equator, which was rendered necessary in order to preserve standard size paper in the face of increasing map scale. This changing scale did not present a serious problem to the user, as its measure was readily available in the meridional scales provided. Any apparent disability was outweighed by the distinct advantage of perfect sheet assembly. Directional radio aids were not in extensive use at the inception of the scheme. The need of those who utilized such aids was catered for by a nomogram for loxodrome/orthodrome conversion.

The Australian Aeronautical Map was compiled from a wide variety of material gleaned from numerous sources—official and otherwise. It was a civilian creation, conceived in peace and developed in war. Originally intended for production in the prestige class, the advent and extension of the war necessitated a reduction in standards of pre-

sentation, though not in content and accuracy. The first edition was of two colours, black and blue, but a full colour scheme was soon provided with colours selected for viewing under the system of cockpit lighting then in use. In all, 132 sheets of the series were produced and published in up to five editions. Production ceased with the formation of the International Civil Aviation Organization and the acceptance by Australia of its standards and recommended practices for aeronautical charts. The A.A. Map has now been entirely superseded and is no longer available.

In November 1944 at Chicago, an International Civil Aviation Conference was held at which 52 States were represented and from which emerged the Provisional International Civil Aviation Organization (PICAO), which on 4th April 1947 was displaced by a permanent organization (ICAO) with headquarters at Montreal. All phases of aeronautical activity, including chart production, were considered in consultation with Member States. Desirable treatment was recommended by Panels of Experts in the respective fields and promulgated by ICAO as International Standards and Recommended Practices to which all national practices of the Member States should be subordinated.

Specifications for the World Aeronautical Chart (ICAO) 1:1,000,000 and associated charts were issued as Annex 4 to the Convention. The observance by Contracting States of the Standards (essential), and the acceptance of the Recommended Practices (desirable) whenever possible, has created adequate uniformity irrespective of the nationality of the mapping authority, and so contributes to the safety, regularity and efficiency of international air navigation.

The original scheme provided a Mercator Projection zone at the equator, Stereographic Projection at the poles, and three Lambert Conformal Conic Projection zones in between. This proved to be unsuited to the mapping of Australia. It established a zone boundary along parallel of latitude 28°S. The misfit in assembly of interzonal sheets was of intolerable magnitude and it was decided, and later conceded by ICAO, that a unified projection system for Australia appropriate to its own configuration be adopted. However, before the mapping had advanced very far, the world scheme was amended to provide Stereographic for the

polar caps and Lambert Conformal Conic for the rest of the World with a separate projection zone for each tier of charts, a commendable change that restricted distortions to negligible limits.

The sheets of the Series, excluding the polar caps, cover four degrees of latitude by a range of longitude which varies with the latitude, thus tending to equalize sheet size. Sheets are displaced longitudinally to suit the configuration of the land masses and the location of islands. ICAO is essentially a land chart. It does not provide complete ocean cover. Sheets are identified by name and number, the latter being that shown on the Sheet Layout accompanying Annex 4. The sheet number does not have a geographical basis and in this regard it is inferior to I.M.W.

Australia is committed to produce and maintain a total of 56 charts covering the States and adjacent territories. Revision of the topographic base and aeronautical information is systematic and frequent, and the Series is now entering the fourth edition. The charts are being produced by the Division of National Mapping, Department of National Development for the Department of Civil Aviation and are also adapted for use by other Services. They are published for aeronautical use only and are not available to other users.

The Australian Geographical Series (AGS) 1:1,000,000 is the general user counterpart of the World Aeronautical Chart. It carries

the same sheet names and has the same sheet limits as ICAO, but bears IMW sheet numbers and not those of ICAO. In the Australian sphere of mapping responsibility, IMW and ICAO sheet lines are identical.

The topographic base of the ICAO chart, with minor modifications and a change in title, legend and certain margin notations and treatment, provides the AGS sheet. It is reproduced and published concurrently with the parent chart and from the same set of drawings. ICAO information which is to be altered is covered by a flap upon which the special AGS modification appears. During reproduction, each drawing is photographed twice, firstly with the flaps down to obtain the AGS negative, and then with the flaps up or removed to obtain the corresponding ICAO negative. Deletions, scribing and stripping may also be involved. On certain drawings, the dual information may be fairdrawn for separation at the negative stage.

Thus for the expenditure of very little additional labour, a map series has been created for the unrestricted use of the general public. A new edition is published concurrently with each major revision of the corresponding ICAO chart.

AGS is a stop-gap production that will be abandoned progressively in favour of sheets of the new-look International Map of the World when that project can become active again.