

MANUALE DI IDROGRAFIA
PER LA COSTRUZIONE DELLE CARTE MARINE
(Hydrographic Manual for Plotting Nautical Charts)

by Ammiraglio di Divisione G. ROMAGNA MANOIA

THIRD EDITION

Brought up to date by Cap. di Fregata U. GIUDICE

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 17 × 25 cm., XIV + 559 pages, 341 Illustrations and Tables.

The First Edition of this important manual, published in May, 1927, was brought to the attention of readers of the *Hydrographic Review* by an analysis of the work which appeared in the *Hydrographic Review*, Volume V., No. 1, May, 1928, page 278.

Its correction and bringing up to date were undertaken in 1943 by Commander Ugo Giudice under the direction of the author who was still alive at that period, then resumed during 1948 from Chapter IV, Part III.

The general arrangement of the different chapters and subjects dealt with has been retained in the New Edition, for it corresponds to the intention of the author that the manual should become a practical guide for naval officers called upon to make surveys, in the various circumstances which may arise during cruises. Pamphlets published by the makers themselves have been used in descriptions of new instruments, and the chapter relating to photogrammetry was compiled from data supplied by the Istituto Militare, Florence.

The manual is divided into 5 parts :

1. Geodetic elements ;
2. Instruments ;
3. Land operations ;
4. Operations at sea ;
5. Drawing and Reproduction of Charts.

Part I describes :

1. *Fundamental operations in chart construction* : Definition of surfaces of reference and geographical co-ordinates on the ellipsoid and the geoid.

2. *Principal formulae used in geodesy* : Convergence of the meridians, curvature at a point of the ellipsoid, reciprocal azimuths ; resolution of a geodetic triangle and transfer from one system of co-ordinates to another, spherical excess, geographical co-ordinates, polar co-ordinates and rectangular co-ordinates ; relations between the three co-ordinate systems ; calculation of the triangle using navigation formulae.

3. *Projection systems for Nautical Charts* : Gnomonic projection, Mercator isogonic projection, network of meridians and parallels in gnomonic and in Mercator projections.

4. *Methods and fundamental formulae for adjustment of errors* : Theory of least squares ; practical applications : Adjustment of the angles of a triangle, of a round of angles, and of a triangulation chain.

5. *Memoir* recalling a few optical notions applied to telescopes.

Part II deals with instruments :

1. *Levels and levelling.*
2. *Vertical axis goniometers*, theodolites, the *Wild* universal theodolite.
3. *Theory of instrumental errors.*

4. *Use of altazimuthal instruments* : Measurement of azimuthal angles, round of angles ; Measurement of zenithal angles, reduction at centre.

5. *Tacheometers* : *Porro* anallatic telescope, diastimmometric angles, various stadia models ; *Galileo type P* tacheometer, *Salmoiraghi Cleps Mod. 4133* tacheometer ; Topographic plane tables (also called pretorian table), *Galileo* topographic plane table, *Ing. Monticolo* field topographic plane table with prism distancemeter ; *Amm. Magnaghi* prismatic circle.

6. *Altimetry* : Geodetic levellings, refraction ; geometrical levellings ; *Zeiss* precision level ; *Galileo type P* level ; *Salmoiraghi* No. 5181 and 5155 level, *Galileo type M* level ; barometric levellings ; instruments for observation of tides : Mareometers, Thomson tide-gauge, portable lagoon tide-gauge, *Tcnani* pressure tide-gauge.

7. *Signals* : Erection of geodetic and topographic signals, heliostats, *Lepaute* collimating lamp, *Faini* phototelegraphic instrument.

Part III covers field operations :

1. *Reconnaissance* : Theodolite triangulation, method of plane polar co-ordinates. triangulation graphs, method of orthogonal rectilinear co-ordinates, geodetic traverse between two astronomical stations, wirestadimeter, determination of azimuths of sides (system used in survey of Somaliland coast (1937-39)).

2. *Geodetic and topographical bases* : *Bessel* instrument, use of Invar wire, extension of base.

3. *Orientation of Net* : Sun azimuth, circumpolar star azimuth, determination of magnetic variation.

4. *Topography* : Graphical determination of detail points, direct resection, reciprocal resection, determination of detail points by computation, *Hansen* method ; topographical survey by tacheometer and topographical plane table ; special survey of coast line by measurement of depression ; stations at sea ; simultaneous observations ; use of rangefinder.

5. *Photogrammetry* :

Progress ;

Terrestrial photogrammetry : *Santoni* phototheodolite, *Wild* phototheodolite ; stereogrammetry, *Pulfrich* stereocomparator, *Von Orel* stereotopograph ;

Air photogrammetry : The *Nistri*, *Santoni*, *Galileo*, *Wild* and *Zeiss* air photogrammetric cameras ;

Restitution instruments : *Orel-Zeiss*, *Santoni-Galileo* stereocartograph, *Wild* autograph and *Santoni* stereosimplex, *Heide-Hugershoff* air-cartograph, *Poivilliers* stereotopograph, *Nistri* photomultiplex and *Zeiss* multiplex ;

Rectifying apparatus ;

Radial air triangulation, spatial air triangulation, *Santoni* solar photoperiscope ;

Nistri and *Zeiss* multiplex air-projector.

Part IV describes work carried out at sea :

1. Submarine surveying sounding apparatus, boat sounding, counting dial, fish-lead sounding (*aquilone-scandaglio*) and description of *Marty C.E.T.* recorder for fish-lead soundings ;

Deep-sea sounding instruments : Lucas sounding machine, the *Professor De Marchi* Corrections Tables for slope of wire, submarine sentry ;

General discussion on acoustic sounding : Sound velocity, sound transmission, dispersion of sound in sea water, hydrophones, submarine oscillators, *Langevin* sounding machine, *Hughes* magnetostriction sounding machine ;

Methods adopted in carrying out soundings : Following line of soundings, distribution of soundings, boat soundings graph, optimum sounding velocity, sounding by surveying vessel, examination of shoals, submarine sweeping with two sentries, bar sweeping, survey (wire-drag) sweeping, triangulation at sea, use of special marker buoys for survey, special port and anchorage surveys.

Part V deals with preparations for drawing the chart and its reproduction. It begins with a foreword concerning the use of drawing cloth (*tela lucida*) for drawing, followed by an analysis of the different graphical operations necessary for drawing the chart and representing the field of survey.

At the *Istituto Idrografico* the compilation and reproduction of charts are in charge of the Charts Department, which includes the following Divisions :

1. Surveys Division : Draws up the programme of works to be carried out, puts the results to profit and reviews all documents relating to surveys received by the *Istituto Idrografico*.

2. Chart Construction Division : Sees to the making of the technical drawings, and as the case may be, to production of the final sheets or copper-plate engravings.

3. Chart Reproduction Division : Includes the photo-mechanics workshop, zincography printing-shop, and calcography printing-shop ; it also has charge of the reproduction of technical drawings and fair sheets as well as zinc and copper-plate printing.

This chapter also describes the use of a few graphical aids such as the ticonic scale protractor made of copper or engraved ivory similar to the *Jordan* instrument, the station pointer, the pantograph, the reproduction of tracings by transparency on a light table, and the manner of using the *Fiechter* camera lucida. Towards the end of the chapter a few general notes are given on the preparation of plates for printing nautical charts from copper engravings, done by graver, coordinatograph, photo-galvanic engraving, galvanoplasty, the *Gliamas* bichromate-gelatine process, or etching. A concise description of lithographic processes on stone by direct drawing or by transfer is given; also of photozincography and the direct albumen photolithography process.

The paragraph relating to the printing of the charts includes general remarks on printing processes by means of zinc plates, lithography, the offset process, and phototypes on zinc plates ; the rapid autography procedure is also mentioned.

The volume closes with a tabulation of the conventional symbols used on the charts in conformity with international usage, and auxiliary tables extracted from the publications of the *Istituto Geografico Militare*, giving six-place logarithms of the functions of the geoid elements entering into the calculation of geographical positions by the *Delambre* formulae.

H. B.

