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AERODROME OBSTRUCTION CHARTS

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FOREWORD

The Operations Division (OPS) of the Air Navigation Commission, at its Third Session (see Final Report of the Session, Doc 6640-OPS/567, Page 167, Paragraph 8.1) recommended that,

"Since the application of operating limitations and instrument approach-to land procedures are directly dependent upon the provision of detailed information concerning obstacles in the vicinity of an aerodrome, the production of Aerodrome Obstruction Charts should be given the highest priority."

The instructions contained in this paper are being circulated to give an indication of the type of information that would be required for portrayal on obstruction charts and as an example of how one of ICAO's Contracting States is handling the survey problem.

The instructions are those issued by the Director, U.S. Coast and Geodetic Survey for the use of airport survey party personnel and are being circulated by permission of the U.S. Government.

The instructions were not intended for publication and general distribution and, consequently, the presentation is less formal and some of the material is not as meticulously selected as would be the case in a reference work or manual intended for publication.

The instructions consider only the field survey operations required for the preparation of Airport Obstruction Plans. The office process (such as compilation, drafting and reproduction) required for the preparation of these plans are not covered in the instructions.

The instructions have just been issued to field parties and are now being used for the first time; it is likely that field use will disclose desirable changes in details.

No Airport Obstruction Plan has as yet been published to comply with these instructions. The charts included in this paper are reduced copies of two typical examples of the current type of U.S. Obstruction Chart. In future, the original scale of 1:12,000 will continue to be used where there are no obstructions beyond the sheet limits at this scale, and the non-existence of obstructions will be indicated by notes; otherwise, it will be necessary to publish the plans at some scale smaller than 1:12,000.

It should be understood that the specifications given in Paragraphs 1.3.1 to 1.3.5 and 4.1 and illustrated in Plates 1 and 2 may not necessarily conform with the Standards and Recommended Practices that may be promulgated eventually in an AGA Annex to the Convention on Civil Aviation.

AERODROME OBSTRUCTION CHARTS

INSTRUCTION FOR OBSTRUCTION PLAN SURVEYS

1.- GENERAL DISCUSSION

1.1 Purpose of Obstruction Plans. Obstruction Plans of airports are published by this Bureau for the use of the Civil Aeronautics Administration and the Air Carriers in computing take-off loads permitted under existing air transport regulations.

1.2 Type of survey. Each Obstruction Plan survey will be designated in the project instructions as either a Type I or a Type II survey. The type of a survey determines only its extent and the definition of an obstruction in certain areas of that survey. The quality, accuracy, and other requirements of all surveys are the same, regardless of type.

1.3 Extent of survey. Each Type I survey will cover an area of about 85 square miles, and each Type II survey an area of about 68 square miles (Plate 1). More specifically, the limits of each survey are formed by the periphery of a Conical Section (C) (1.3.5), and the boundaries of two Instrument Approach Areas (A) (1.3.1), one at each end of the instrument runway, which extend beyond the Conical Section. Within these over-all limits, each survey must determine the position and elevation (above mean sea level) of all natural and cultural obstructions (4.1). Each survey must also determine the mean sea level elevation of the airport, the length and azimuth of each runway, and the horizontal positions of a sufficient number of ground stations to control a radial plot of the area.

1.3.1 Instrument Approach Area. Each survey area contains two Instrument Approach Areas (A), one at each end of the instrument runway.

Each Instrument Approach Area is symmetrically located with respect to the instrument runway centerline extended, and extends from the runway end outward for 50,000 feet measured horizontally along the centerline extended. Each Instrument Approach Area consists of an inner rectangular section, abutting the runway end, and of an outer isosceles trapezoidal section, abutting the outer end of the rectangular section. The rectangular section is 3,100 feet in width (1,550 feet on each side of the runway centerline extended), and 6,217 feet in length, its sides terminating where they intersect the sides of the trapezoidal section. The sides of the isosceles trapezoidal section are the extensions of lines originating at the center of the end of the runway, and flaring outward at an angle of 14° on each side of the runway centerline extended (Plate 1).

1.3.2 Noninstrument Approach Area. Each survey area contains one Noninstrument Approach Area (N) at each end of each noninstrument runway. Noninstrument Approach Areas are exactly similar in all respects and dimensions to Instrument Approach Areas, except that Noninstrument Approach Areas are located at the ends of noninstrument runways, and extend outward for a total of only 10,000 feet from the runway end.

1.3.3 Runway Area. The Runway Area (R) encloses all of the runways. For a single-runway, the Runway Area is rectangular in shape. Its length is the length of the runway, and its width is 3,100 feet (1,550 feet on each side of the runway centerline). For a system of runways, such as usually encountered at an airport, the limits of the Runway Area are the outermost limits of the overlapping, single-runway areas (Plate 1).

1.3.4 Horizontal Area. The Horizontal Area (H) is circular in shape, with its center at the mid-point of the instrument runway. Its radius is 13,000 feet for a Type I survey, and 10,000 feet for a Type II survey. (Dimension a, Plate 1). The Instrument Approach, Noninstrument Approach, and Runway Areas are excluded from the Horizontal Area.

1.3.5 Conical Section. The Conical Section is concentric with the Horizontal Area, and extends radially outward (Dimension b, Plate 1) beyond the circumference of the Horizontal Area 7,000 feet for a Type I survey and 5,000 feet for a Type II survey. The Instrument Approach and Noninstrument Approach Areas are excluded from the Conical Section.

1.4 Data furnished to survey party. The following listed data, if available, are furnished to the field party prior to the survey:

- 1) Aerial Photographs;
- 2) Horizontal and vertical control data;

- 3) Airport plans;
- 4) Planimetric and topographic maps of the area;
- 5) Approach and Landing Charts.

1.5 Types of field operations. Obstructions surveys will ordinarily consist of the following operations:

- 1) Horizontal control survey;
- 2) Leveling;
- 3) Selection of obstructions;
- 4) Determination of position and elevation of obstructions;
- 5) Field computations.

1.6 Obstruction plans of other organizations. The data on obstruction plans prepared by other organizations shall not be accepted. Obstruction plans of other organizations, however, may be used for planning the operations of a new survey.

2.- HORIZONTAL CONTROL SURVEYS

2.1 Local control scheme. A local horizontal control scheme shall be established at each airport unless (a) the project instructions specifically state that such control is not required, or (b) such control has been established during a previous survey (2.1.4). The local control scheme is used for the following purposes:

- 1) To control the radial plot;
- 2) To serve as a base for locating obstructions by intersection methods;
- 3) To determine the lengths and azimuths of the runways;
- 4) To correlate the maps and plans used in the survey;
- 5) To facilitate future revision surveys.

2.1.1 Selection of local control stations. An ideal selection of local control stations includes main scheme stations consisting of the airport control tower, the airport beacon, and stations located at the ends of each runway; and supplementary stations located at approximately regular intervals at, or beyond, the outermost obstructions of the survey area. Supplementary stations will normally consist of such elevated objects as building finials, chimneys, radio masts, and tanks that are visible from the main scheme stations. Main scheme ground stations, such as those at the ends of the runway, are usually designated by letters of the alphabet. A control layout diagram shall be prepared on one of the following: (1) an airport plan, (2) the landing chart, or (3) in the field record book, and submitted with the completed survey data.

2.1.2 Identification of control stations. Each control station shall be identified on an aerial photograph with an accuracy of plus or minus 0.15 mm. Where the photograph is 1:12,000 scale, this tolerance is equivalent to about 6 feet on the ground. Each selected control station shall be designated on the photograph by its assigned letter of the alphabet or appropriate descriptive title. Federal control stations of third-order accuracy or better shall be enclosed by an inked triangle, and all other control stations by an inked square. All control stations shall be identified on the photographs in accordance with Photogrammetry Instructions No. 22.

2.1.3 Development of control scheme. The control scheme may be developed from the base line by either triangulation or traverse or by a combination of the two. The two ends of the base line must always be occupied, and as many as practicable of the other main scheme stations shall also be occupied. All unoccupied main scheme stations should either be intersected from at least three other stations, or intersected from two stations with the length of one unknown side of the triangle taped. Supplementary stations should be intersected from three main scheme stations. Usually it is not practicable to occupy the supplementary stations. A single direction should be observed to a supplementary station in any large part of the survey area where it is not practicable to locate a station by complete observations. It should be remembered that some data are usually better than none at all; such a direction serves to strengthen a radial plot in one direction.

2.1.4 Use of previously established control. If a control scheme has been established during a previous obstruction survey, its stations may be used for base lines, or for other purposes, during a new survey provided (a) a sufficient number of the original stations can be positively recovered to make its use practicable, and (b) a line, other than the base line of the original scheme is taped, and checks the original survey length by 1:2,000 or better.

2.2 Control scheme base line. The base line from which the local control scheme is developed shall be laid out between two control stations at the opposite ends of a runway, wherever practicable. The base line shall be selected so as to obtain the best practicable intersection angles on the other main scheme stations. The base line shall be double-taped with an agreement between the two tapings of 1 part in 5,000 or better. The taping shall be along the surface of the runway and shall be corrected to the horizontal if the slope of the runway is greater than 10 feet in 1,000 feet.

2.3 Measurement of angles. All control scheme angles shall be measured by the direction method. The same initial station (generally an airport beacon or the control tower) shall be used from each occupied station, wherever practicable. One direct reading and one reverse reading of each angle shall be made and both verniers shall be recorded for each pointing. All angle observations shall be recorded in "Horizontal Angle Observations", Form 250.

2.4 Accuracy requirements. The best of the angles at an intersected station shall seldom be less than 12° . The computed sides of the triangles formed by the main scheme stations shall check within 1 part in 4,000; those for the supplemental stations shall check within 1 part in 2,000. At least one computed side of one of the triangles formed by the main scheme stations shall be taped and shall check the computed length by 1 part in 4,000.

2.5 Azimuth observations. Observations shall be made so that the azimuth can be determined for one line of the local control scheme (preferably the base line) by one of the following methods: (1) solar observations; (2) polaris observations; or (3) an adequate and self-checking azimuth connection to geodetic datum (2.7).

2.5.1 Solar observations. The solar observations shall consist of two sets of four pointings each on the sun. Detailed instructions for solar azimuth observations are contained in Photogrammetry Instructions No. 19. The observations shall be tested graphically for accuracy and repeated if necessary to obtain a satisfactory set of readings.

2.5.2 Polaris observations. Detailed instructions for making polaris observations are contained in Photogrammetry Instructions No. 4.

2.6 Lengths and azimuths of runways. A control station shall always be established at each end of each runway to provide the runway/