

SPECIFICATIONS FOR AERIAL PHOTOGRAPHY

for U. S. Navy Hydrographic Office

(15 June 1946, revised July, 1947).

FOREWORD

The following is a copy of "Specifications for Aerial Photography for U. S. Navy Hydrographic Office". These specifications have been prepared in accordance with Hydrographic Office requirements for mapping photography taking into consideration the stereo-mapping equipment now available to this Office, as well as, in accordance with the conclusions of the War Department Mapping Conference, Washington, D. C., 18-26 February 1946. Adherence to these specifications will insure that the photographs being acquired will be satisfactory and adequate for accurate photogrammetric compilations for both the U. S. Navy and the U. S. Army.

These specifications contemplate five (5) types of photography as specified in Sections 2 thru 6, namely :—

(a) SECTION II.—*Basic vertical photography*.—This photography will, in general, be required for all coastal and island areas for Navy large scale charting purposes.

(b) SECTION III.—*Supplemental vertical photography for cultural detail*.—This photography is required to supplement the basic vertical coverage and thereby permit interpretation of planimetry in greater detail.

(c) SECTION IV.—*Control trimetrogon photography, supplementing basic vertical photography*.—This photography is required to aid in controlling the basic vertical photography and to tie outlying areas.

(d) SECTION V.—*Views, Oblique photography*.—This type of photography is for use in Naval Air Pilots, Route Manuals and other Hydrographic Office publications.

(e) SECTION VI.—*Trimetrogon charting photography*.—This type of photography, in general, is required for small scale aeronautical charting.

SECTION I

GENERAL SPECIFICATIONS

Applicable to all types of photography, Sections II through VI, except where so noted.

ART. 1.—*Crab (vertical photography)*.—(a) Crabbing of photographs shall not in any case exceed 5 degrees from the established course line and shall not average more than 2 1/2 degrees deviation for each flight strip. These specifications apply to all vertical photography, including the vertical exposures of Trimetrogon photography.

ART. 2.—*Tilt (vertical photography)*.—(a) The axis of the camera shall be maintained as nearly as possible in a vertical position during each exposure and in no case shall the tilt from the vertical exceed three (3) degrees, and should not average more than two (2) degrees in any ten (10) mile section of a flight line, nor more than one (1) degree for the entire project. This also applies to the vertical exposures of Trimetrogon photography.

ART. 3.—*Overlap (vertical photography)*.—(a) Overlap in the line of flight, or forward overlap, shall average approximately 60 per cent. It is mandatory that it shall be not less than 55 per cent, nor more than 65 per cent. This pertains to the vertical exposures of Trimetrogon photography as well.

ART. 4.—*Flight Lines* (Not applicable to Sect. v, Oblique views).—(a) No photographs shall be taken on “banks” between successive courses, but each course shall be flown and photographed independently, by turning back at the end of the preceding course and getting into position on the protracted line of the new course at least three miles behind the point at which the first exposure is to be made.

(b) Whenever possible each flight line shall be flown as one continuous flight. In cases when it becomes necessary that the flight line be broken, the tie should be picked up meeting specifications for crab and overlap. The maximum overlap in line of flight at any such break will not be limited.

ART. 5.—*Time of photography*.—(a) Aerial photography should be performed only on days of clear and cloudless weather, and during that period of the day when the sun is at an altitude of 30 degrees or over for the area being photographed. For extremely rugged areas, the minimum solar altitude should be increased to 40 degrees. For areas having little or no relief, the solar altitude may be less than 30 degree providing the solar light is adequate for photographic purposes. The flight crew should use discretion regarding the solar altitude when working in the polar regions.

(b) In some instances, photography may be accomplished where small isolated clouds are present but these clouds should not cover more than one-tenth of any negative. This is particularly critical in the case of cross flights.

(c) Photography may be possible when a thin, streaked, high cirrus cloud formation is above the mapping plane, but not when there is a heavy cirrus overcast.

ART. 6.—*Quality of Negatives*.—(a) Fine grain emulsion, topo base film must be used.

(b) Film should be kept in a cool dark place before exposure and should be processed in a fresh, clean developer of proper contrast as early as practical after exposure. This time must not exceed two weeks. Film will be rejected unless it is free from all chemical stains, scratches, light streaks, fog, static marks or any other blemishes obscuring terrain detail.

(c) Special care should be exercised to insure the proper development and the thorough fixation and washing of all film, and to avoid rolling film tightly on drums, or in any way distorting it during processing and drying.

(d) Negatives must be of a maximum fineness of grain. The exposure and development of the film should be calculated to yield a maximum sharpness of all detail, avoiding extreme highlights or dense shadows, which might in any way obscure the detail. Particular care must be taken to secure maximum detail in the corners of the negatives. The negatives should be of uniform medium density and sufficient contrast to clearly demarcate boundaries of roads, fields, and woods. Specifically, negatives should be so exposed and processed that the minimum density, as measured with a densitometer with a scale range of 0 to 3.0, should not be less than 0.3, and the maximum density not greater than 1.5; the gamma (contrast) factor shall not exceed 1.0 nor be less than 0.6. To obtain negatives with these specifications, the exposure should be more than normally required and the time of development curtailed.

(e) Index numbers must be placed on the film in accordance with Art. 8, Sect. 1 and shall at no time mask any terrain detail.

ART. 7.—*Contact Prints* (Not applicable to Sect. v, Oblique views).—(a) As soon as each area is completed, four (4) sets of prints from the negatives shall be made on Eastman Low Shrink paper, or any other photographic paper equal to Air Map Special. Unless otherwise stated, the prints will be made *without* masks.

(b) All prints shall be clean and absolutely free from finger marks, chemical stains, light fog or streaks, uneven spots, airbells, static marks or any other blemishes that might delete terrain detail. The prints must be thoroughly washed to insure their permanency and must be delivered in a smooth, flat condition.

(c) Prints shall be of uniform color and density and shall be of such a degree of contrast that all detail of the negatives will show clearly, both in the shadows and the highlights as well as in the half tones between shadows and highlights. This degree of clarity and tone shall be maintained right out to the corners of the print.

ART. 8.—*Indexing*.—(a) The designating index symbol and serial numbers shall be placed in the lower right hand corner looking down the flight line (see Sections 11 to 16 for individual instructions). The numerical abbreviation of the month, day, and year of photography should be clearly marked on the first and last exposure of each run. (Thus: 12-8-43 appearing on the film would indicate that the photography was exposed on 8 December 1943).

The date of photography should be placed in the lower left hand corner looking down the flight line. It is imperative that the index information be placed on the film without masking out any of the terrain detail. The rolls of film used in the performance of each project shall be numbered in an unbroken series beginning in each case with number 1.

(b) Index charts will be prepared by the aerial survey unit showing the position, number, roll number, and the exposure number at the beginning and end of each flight line in the project, as well as the date of photography. This may be done by adding the required information on the flight charts furnished by the Hydrographic Office, and making photo or photostat copies. The Hydrographic Office will make smooth and complete indexes on receipt of the survey data.

ART. 9.—*Data Sheet.*—(a) A data sheet will be prepared on which will be shown complete information about each flight run. Sample data sheets are attached at the end of each section showing the form and amount of information desired (runs should be tabulated in numerical sequence).

ART. 10.—*Inaccuracy of charts.*—(a) On many projects, the best available maps or charts are very inaccurate. When the aerial survey unit notes islands, shoals, etc., which do not appear on the charts, and are not included in the flight lines, the unit should make every effort to photograph such areas, and tie them in, if practicable, by flight lines to the project.

ART. 11.—*Outlying island and shoals.*—(a) In case of small detached islands or shoals, it is essential that at least three successive exposures, with proper overlap, be taken thereof to permit proper photogrammetric compilation.

ART. 12.—*Ground control data.*—(a) These specifications also contemplate the aerial survey unit assisting the hydrographic survey party in obtaining ground control data. Occasionally the hydrographic survey unit will be working in the same area and at the same time as the aerial survey unit. The aerial survey unit will, therefore, give the hydrographic survey unit any assistance that may be required in the identification of control stations on the mapping prints, by photographing the stations at low altitude. Overlapping stereo-pairs would be preferred for purposes of control station identification. When necessary to expedite the survey, the aerial survey unit will also aid the hydrographic survey unit, by transporting the parties by plane from one station to another.

ART. 13.—*Inspection.*—(a) Due to the expense involved, the remoteness from the home base of the area being photographed, and particularly the absolute necessity of the photography being performed in accordance with these specifications it is urged that a complete field inspection be made before the photographic survey unit leaves the area.

(b) It is recommended that whenever practicable the inspection be made by printing every other print in the run, then, laying these prints in a mosaic pattern and checking for coverage and for proper overlap and sidelap.

SECTION II

BASIC VERTICAL PHOTOGRAPHY

ART. 1.—*Area to be photographed.*—(a) The area to be photographed will be outlined on a small scale chart by the Hydrographic Office.

(b) In general for large land areas, photography will be required of the coastal area to a depth of from 15 to 20 miles, and for island areas complete coverage will be required.

ART. 2.—*Camera to be used.*—(a) Basic photography will be accomplished with a single lens mapping camera having a calibrated focal distance of between 151.0 mm. and 155.0 mm. on a 9 × 9 inch negative.

(b) The camera shall be so equipped that negatives are held in a flat plane at the instant of exposure and the location of the principal point is directly shown, or may be determined from collimation marks appearing on each negative.

(c) A standard K-17 camera or equal is considered acceptable. When available, a more precise, 6" focal length, Metrogon camera would be preferred.

ART. 3.—*Filters.*—(a) For all vertical photography, filters will be used — the type of filters used depending upon the haze conditions. Aro 2, Minus Blue and No. 25 filters may

be used. Unless specifically indicated, the infra red filters will *not* be used. Filters made from stained optical "A" glass are preferable, but if they are not obtainable, the gelatin filter properly mounted in a standard filter frame will be acceptable.

(b) The "Hot Spot" characteristic in photography taken with the wide angle metrogon lens shall be reduced to a minimum by use of the standard vignetting correction filter.

ART. 4.—*Flight altitude.*—(a) When operationally feasible, basic photography of large land areas will generally be accomplished at a corrected altitude of 15,000 or 20,000 feet above mean average terrain, yielding photography at an approximate scale of 1:30 000 or 1:40 000 respectively. The Hydrographic Office will in all cases specify the altitude in areas where hydrographic surveys are planned or exist.

(b) For small islands whose maximum dimensions do not exceed ten (10) miles, basic photography shall be accomplished at an altitude above mean terrain between 5,000 and 10,000 feet; the exact altitude to be selected by the Hydrographic Office. In addition, where the island is one of a compact group or is surrounded by a reef, the group or the island and reef shall be covered by one or more vertical flights at the highest practicable altitude and/or Trimetrogon control flights.

(c) In any case, where the characteristics of the aircraft to be employed, and/or consistent climatic conditions prevent expeditious and economical coverage by basic photography at the optimum scale of 1:40 000, coverage at not less than 15,000 feet above mean terrain elevation will be authorized. In every such case uniformity within 400 feet plus, or minus, of the specified altitude shall be maintained.

(d) The mapping crews should exercise great care in determining the true altitude, taking readings of outside air temperature at each 1,000 feet and employ the proper tables for the correction of altimeter error.

ART. 5.—*Flight lines.*—(a) Flight lines will usually be laid out by the Hydrographic Office in advance of the survey. In general, the flight lines will run parallel to the coast line to a depth of from 15 to 20 miles with an additional flight line running normal to the coast line about every sixteen (16) miles. If the flying height deviates from 20,000 ft., the distance between the cross flights will be proportionately changed (see Section 11). Flight lines for islands will be parallel to the longest dimension of the island with at least one flight over the center normal to the main flight lines. The mean bearings of adjacent strips shall be within five degrees of parallel. Particular care shall be exercised to keep all flight lines straight and as nearly parallel as possible. In no case shall the lack of parallelism between adjacent photographic strips be such as to prevent the sidelap between photographs from conforming with the sidelap requirements of Art. 6 of this section.

(b) Whenever, due to any cause, reflights are necessary, the reflights shall extend at least five (5) exposures each way beyond the cause of such reflight.

ART. 6.—*Sidelap.*—(a) The sidelap between adjacent flight lines shall average 35 per cent. Any sidelap of less than 25 per cent or more than 45 per cent, shall be considered sufficient reason for rejecting all photographs made on that particular flight line. (See table, for proper distance between flight lines for various scales.)

ART. 7.—*Indexing.*—(a) Each negative shall be marked clearly with a designating area symbol not to exceed three letters, followed by the serial number of the roll and the serial number of the exposure on the roll (thus, an example: "BAH 6-121" appearing on the film would indicate Bahama Project, Roll 6, exposure 121).

DISTANCE BETWEEN FLIGHT LINES
Allowing 35% sidelap on 9" × 9" negative

Scale	Distance - Feet	Distance - Miles	
		Statute Miles	Nautical Miles
1: 10 000	4,875	0.92	0.80
1: 12 000	5,850	1.11	0.96
1: 14 000	6,825	1.29	1.12
1: 20 000	9,750	1.85	1.60
1: 24 000	11,700	2.22	1.92
1: 30 000	14,625	2.77	2.41
1: 36 000	17,550	3.32	2.89
1: 40 000	19,500	3.69	3.21

DISTANCE BETWEEN CROSS FLIGHTS

(See : Art. 5, Sect. II)

Scale	Statute Miles	Nautical Miles
1 : 10 000	4.0	3.5
1 : 12 000	4.5	4.0
1 : 14 000	5.5	4.5
1 : 20 000	8.0	7.0
1 : 24 000	9.5	8.0
1 : 30 000	12.0	10.5
1 : 36 000	14.5	12.5
1 : 40 000	16.0	14.0

SECTION III

SUPPLEMENTAL VERTICAL PHOTOGRAPHY FOR CULTURAL DETAIL

ART. 1.—*Purpose*.—(a) Additional photography to supplement basic coverage, and thereby permit interpretation of planimetry in greater detail, will be accomplished for areas of intense culture. Areas of intense culture are defined to include cities, towns, ports and harbors, highly developed agricultural areas, etc.

(b) Where basic photography is accomplished at scales greater than 1:20 000 (Art. 4, Section 1), supplemental photography will not be required.

ART. 2.—*Scale of Photography*.—(a) Supplemental photography shall be accomplished at scales ranging from 1:5 000 to 1:20 000 as specified by the Hydrographic Office, or at the discretion of the unit commander or flight crew.

(b) On many projects, the best available maps or charts are very inaccurate, and/or lacking in sufficient detail to determine the exact areas and scales where supplemental photography is required. When, therefore, the aerial survey unit notes such areas which are not selected by the Hydrographic Office, the unit should obtain supplemental photography of such areas, using their judgment as to scale and limits thereof.

ART. 3.—*Camera to be used*.—(a) Supplemental photography may be accomplished with any of the following, or equivalent, aerial cameras :

- K-17, 6-inch, 9" × 9" photograph ;
- K-17, 12-inch, 9" × 9" photograph ;
- K-17, 24-inch, 9" × 9" photograph ;
- K-18, 24-inch, 9" × 18" photograph.

ART. 4.—*Flight Lines*.—(a) Flight lines will be parallel to the longest dimension of the area whenever practicable.

(b) All other requirements will be the same as for (Article 5, Section 11).

ART. 5.—*Sidelap*.—(a) The sidelap between adjacent flightlines shall average 30 per cent and any sidelap of less than 15 per cent or more than 45 per cent shall be considered sufficient reason for rejecting all photographs made on that particular flight line. (See Table, Section 11, page 11.) Since only 30 per cent sidelap is required for supplemental vertical photography, multiply distances on this table by 1.08.

ART. 6.—*Indexing*.—(a) Negatives shall be numbered the same as for basic vertical photography (Article 7, Section 11), except that the letters "SP" shall follow the area designation. (Thus an example, "BAH-SP-6-121" appearing on the film would indicate Bahama Project, Supplemental Photography, Roll 6, exposure 121).

SECTION IV

**CONTROL TRIMETROGON PHOTOGRAPHY,
SUPPLEMENTING BASIC VERTICAL MAPPING PHOTOGRAPHY**

ART. 1.—*Area to be photographed*.—(a) The area to be photographed will be the same as for basic vertical photography.

ART. 2.—*Cameras to be used*.—(a) Photography shall be accomplished with K-17 cameras having a calibrated focal distance of between 151.0 mm. and 155.0 mm. Whenever available, a more precise 6" focal length, Metrogon camera would be preferred.

(b) The cameras shall be mounted in the standard Trimetrogon camera mount installations.

ART. 3.—*Filters*.—(a) Proper filters shall be used to reduce atmospheric haze to a minimum with special attention to bringing out the apparent horizon to maximum clarity.

(b) The "Hot Spot" characteristic in photography taken with the wide angle Metrogon lens, shall be reduced to a minimum by use of the standard vignetting correction filter.

ART. 4.—*Flight altitude*.—(a) When operationally possible, the flight altitude shall be at a corrected altitude of 20,000 feet and in no case shall it be less than 15,000 feet above

mean terrain elevation. In every such case uniformity within 400 feet plus or minus the specified altitude shall be maintained.

ART. 5.—*Flight lines*.—(a) Flight lines will usually be laid out by the Hydrographic Office in advance of the survey. In general, for large land areas, one flight strip will run parallel to the coast line and adjacent thereto; this flight to be flown just enough inshore so that the vertical will be entirely over land. A second strip shall be flown approximately fifteen (15) miles inland and parallel to the coast strip. In the event the altitude above mean terrain is decreased below 20,000 feet, the inland flight will be moved one mile closer to the coast flight for each 1,000 feet decrease in altitude. In the event altitude above mean terrain is increased above 20,000 feet, the flight line spacing will remain at 15 miles. In addition, where an island group lies five (5) to eight (8) miles offshore, an additional strip should be flown parallel to the main coast strip and directly over the group.

(b) In cases of isolated island groups, control Trimetrogon photography should be flown so that the islands within a group and different island groups can be tied photographically together.

ART. 6.—*Sidelap*.—(a) Specifications for spacing of flight lines (Article 5 of this section) provide for the necessary sidelap.

ART. 7.—*Indexing*.—(a) Each negative shall be marked clearly with, first "TRM" and then with a designating area symbol not to exceed three letters, followed by either "L" (for left roll), "V" (for the vertical roll), or "R" (for the right roll), followed by the serial number of the roll and the serial number of the exposure on the roll. Extreme caution must be taken to designate all three rolls of each Trimetrogon flight line by the same roll number. All simultaneous exposures must bear the same exposure number as well as the same roll number. Hence, the only difference in the designation of simultaneous exposures would be the letter L, V, or R inserted between the project area symbol and the roll number. For example: TRM-BAH-R-6-121 appearing on the film would indicate Trimetrogon of the Bahama Project, Right hand (or right oblique) roll No. 6, exposure 121. The vertical and left oblique exposed at the same time would be marked, respectively: TRM-BAH-V-6-121 and TRM-BAH-L-6-21.

SECTION V

VIEWS, OBLIQUE NEGATIVES

ART. 1.—*Purpose*.—(a) This type of photography is for use in Naval Air Pilots, Route Manuals, and other Hydrographic Office publications.

(b) Air Navigation Views are intended for identification purposes and to assist aviators in the approach and let-down to landplane and seaplane facilities.

(c) Sea Coast Approach Air Views are intended to assist surface navigators in identifying their location, particularly in the vicinity of lighthouses, headlands, harbor entrances, etc.

ART. 2.—*Requirements (Air Navigation Views)*.—(a) Photographs shall be of good photographic quality suitable for half-tone reproduction.

(b) The photographs shall be of two general types. One type shall cover the general area in which the facility is located; the other shall cover the facility and immediate vicinity.

(c) The photographs shall be taken from the normal directions and altitudes of approach and let-down to the facility.

(d) The facility shall be centered on the photograph as nearly as possible, and the photograph shall show obstructions and prominent landmarks in the vicinity of the facility as far as practicable.

ART. 3.—*Requirements (Sea Coast Approach Air Views)*.—(a) Same as for Art. 2 except that the photographs shall be taken at an altitude of approximately 5,000 feet above sea level datum and in a direction from which the surface navigator would view the subject, navigating the normal sea lanes in the area. The coastline trace should fall as close as possible to the lower or foreground edge of the photograph.

ART. 4.—*Area to be photographed*.—(a) The area to be photographed will be the same as for basic vertical photography.

(b) The approximate altitude and direction from which each Air Navigation View is to be taken shall be those normally used in the approach and let-down to the respective landplane field or seaplane anchorages.

ART. 5.—*Camera to be used.*—(a) Photographs shall be made with a single lens mapping camera having a focal length of 12 inches, and a negative size of not less than 9 inches by 9 inches.

(b) The camera shall be so equipped that negatives are held in a flat plane at the instant of exposure and the location of the principal point is directly shown or may be determined from collimation marks appearing on each negative.

ART. 6.—*Filters.*—(a) Density correcting filters suitable for haze conditions shall be used such as Minus Blue and No. 25. Infra red filters will not be used unless specified.

ART. 7.—*Film.*—(a) A standard panchromatic aerial film shall be used. No film should be used on a date later than that specified on the film by the manufacturer, unless actual tests show that the film is still satisfactory.

(b) Film should be kept in a cool dark place before exposure and should be processed in a fresh developer of proper contrast as early as practicable after exposure.

(c) Special care shall be exercised to insure the proper development and the thorough fixation and washing of all film, and to avoid rolling film tightly on drums or in any way distorting it during processing and drying.

ART. 8.—*Light and weather condition suitable for photography.*—(a) Photography shall not be attempted unless the sun is at least two and one half hours (37 degrees) above the horizon.

(b) Photography should not be attempted when cumulus clouds or cloud shadows obscure the ground area to be covered. In some instances, a thin uniform cirrus overcast may not interfere with successful photography.

ART. 9.—*Contact prints.*—(a) Same as Art. 7, Section 1, except that 2 sets each are required, printed on single weight glossy paper, ferrotyped.

ART. 10.—*Indexing.*—(a) Negatives shall be numbered the same as for basic vertical photography except that the letters "OV" shall follow the area designation (thus: "BAH-OV-6-121" appearing on the film would indicate Bahama Project, Oblique Views, Roll 6, exposure 121).

ART. 11.—*Inaccuracy of charts.*—(a) On many projects the best available maps and charts do not show all features, such as prominent landmarks, obstructions, lighthouses, headlands, harbors, landplane fields, and seaplane anchorages. Therefore, when the aerial survey unit notes such features as listed above, that do not appear on the flight chart, and are not included in the oblique views, the unit should make every effort to photograph such features and facilities.

SECTION VI

TRIMETROGON CHARTING PHOTOGRAPHY

ART. 1.—*Area to be photographed.*—(a) The area to be photographed will be outlined on a small scale chart by the Hydrographic Office.

(b) Complete photographic coverage will be accomplished by subdividing the area into blocks. Each block will have a planned pattern of properly spaced parallel flight lines. There shall not be a difference in altitude above mean terrain of more than 5,000 feet between the highest and the lowest flight line in any block. Blocks should be at least the area of one 1:1,000,000 scale aeronautical chart in extent but blocks of four or more aeronautical chart areas in extent are preferable. Block boundaries should coincide as nearly as possible with the world Aeronautical Chart breakdown on 1:1,000,000 scale, 1:500,000 scale or 1:250,000, in that order of preference. There should be at least a 15 mile overlap between adjoining blocks. Every effort should be made to complete each area by successive blocks, including re-flights for gaps and clouds, so that the entire block may be compiled as a unit.

ART. 2.—*Cameras to be used.*—(Same as in Art. 2, Section IV).

ART. 3.—*Filters*.—(Same as in Art. 3, Section IV).

ART. 4.—*Flight altitude*.—(Same as in Art. 4, Section IV).

ART. 5.—*Flight lines*.—(a) Flight lines will be parallel to the longest dimension of the area whenever practicable. Flight line spacing will be 15 miles apart for normal operations at 20,000 feet above mean terrain. In the event altitude above mean terrain is decreased below 20,000 feet, flight lines will be moved one mile closer together for each 1000 feet decrease in altitude. In the event altitude above mean terrain is increased above 20,000 feet, the flight line spacing will remain at 15 miles. There shall not be a difference in altitude above mean terrain of more than 5,000 feet between the highest and the lowest flight line in any block.

(b) Where flight lines parallel the coast, the flight line adjacent to the coast will be flown inshore as far as possible while still including the beach on the vertical. If possible, flight lines will be flown so that the principal point of not more than two consecutive verticals will be over water. Where flight lines do not parallel the coast, but start or end on the coast, an additional flight will be made along the shoreline of the area in the manner specified above. In accomplishing coastline strips, it is desired that all three cameras be operated since knowledge of the presence or absence of islands, reefs, rocks or shoal water for at least 10 miles offshore is important.

(c) Tie-flights will be flown perpendicularly across the basic project as near the ends of the flight lines as practicable, and will be flown perpendicularly across the project at one or more convenient points between the ends of the basic flight lines. These tie-flights should be spaced roughly 100 miles apart.

ART. 6.—*Sidelap*.—(a) Specifications for spacing of flight lines (Art. 5, of this section) provide for the necessary sidelap.

ART. 7.—*Indexing*.—(Same as in Art. 7, Section IV).

