Chart Revisions

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ABSTRACT: *The land information on nautical charts must be kept up-to-date to provide adequate assistance to the mariner. Aerial photographs supply the source material necessary for such revision. The selection of photography, the problems raised by its application to the chart drawings, and the methods of solution are described.*

A NAUTICAL chart is effective and useful for navigation only if it is maintained up-to-date with changes. Much of the coastline of the United States is subject to rapid and continual change by both storms and by cultural developments. Consequently, the major part of the nautical charting effort of the Coast and Geodetic Survey is devoted to revising or maintaining the approximately 800 charts on issue.

While the water depths and underwater obstructions are of primary importance, the land information on these charts must also be maintained up-to-date. This is particularly true for the more than 350 charts, published at a scale of 1:40,000 and larger, for navigation in harbors and inland waters, where the shoreline and prominent topographic features near the shore assist the mariner in navigating. Aerial photographs provide excellent source material for revising the land information since they can be obtained quickly following changes, and can be readily applied to the chart drawings.

In maintaining the topographic informations on charts it is necessary to find the time and place of the changes, obtain aerial photographs, and correct the chart drawings as soon thereafter as possible. The procedures are briefly as follows but are later on discussed in more detail.

Topographic and planimetric maps described elsewhere in an accompanying paper by Bennett G. Jones provide the basic information for compiling land details on the chart drawings. Subsequent changes that affect the charts are reported by field survey parties and are detected by aerial reconnaissance of changeable areas. New aerial photographs are taken and are used to correct the chart drawing. Changes noted on the drawing are then applied to the glass negatives for that chart, and a new issue of the chart is printed. The original engraved, wet-plate, glass negatives for each chart are permanently filed for use in revisions and reprints. When a revision is necessary, the changed areas are opaqued on these original glass negatives. A fac-simile image of the revised area is then transferred from the corrected chart drawing to the glass negative, and the new details engraved thereon. The revised negatives are then used for preparing new press plates for printing.

Aerial photography to be used for the revision of reported changes is taken, in the spring and fall of each year, by the Photographic Mission that takes mapping photography in the United States and Alaska. This scheduled photography is not sufficient, however, since small but significant changes often have not been reported and photographed. Consequently, an aerial reconnaissance of the changeable areas is made every one to three years using a light airplane. The coastline and the water front of harbors are examined by flying at altitudes of 2,000 to 3,000 feet, and are compared with nautical charts. Changed areas not previously detected are then photographed. Single-lens photography is used for most chart revision work; this is usually taken at a contact scale-ratio of 1:10,000, i.e., at a flight altitude of 5,000 feet. Higher altitude photography is taken occasionally where photogrammetric plotting is necessary for extensive changes; low altitude photography is sometimes taken for studying changes in navigation aids or other special purposes.

Infrared photography is often utilized as it affords the maximum penetration of atmospheric haze. It also offers a stronger contrast between land and water areas; in delta areas, for instance, the shoreline is

immediately discernible and mud flats or bars can be accurately depicted.

New aerial photographs are indexed on copies of the various nautical charts of the area flown and are closely inspected for changes of immediate importance to navigation. These include such as changes in aids to navigation, new piers of importance to shipping, destroyed piers, inlets and entrance channels closed by storms, and new inlets opened by storms. Changes of immediate importance to navigation are reported in the "Notice to Mariners"; this serves as a supplement to the nautical chart until a new printing of the chart can be made.

The revision of each chart drawing is scheduled according to a chart Exhaustion Report which predicts the date of exhaustion of the current supply of copies. When the supply reaches a particular point on this report, that chart is given a priority which will permit revision and a new printing at about the time the supply of charts has been distributed.

The first step in revising a chart drawing is to examine the photographs for the purpose of determining the nature and extent of the changes. Many are of small extent and can be made directly from the photographs to the drawings. The photographs are then studied under a stereoscope and the information to be transferred to the chart drawing is inked on the photographs in contrasting color. Details are selected and generalized according to the scale of the chart which is always smaller than the photographs. To guide the compiler in interpreting the shoreline (mean high-water line) on the photographs, the stage of the tide at the time of photography is determined from actual tide observations or is computed from the predicted tide tables when the former are not available. The information inked on the photographs is then transferred to the chart drawing and is positioned thereon by holding to permanent details visible on both the chart and the photograph.

At present, two chart bases are used for revision. First, a buff, drawing-paper copy of the chart which, when corrections are drawn on it with red ink, becomes known as a "Drawing." Until recently, this base has been the standard revision copy. Second, a print of the chart on transparent plastic. When corrections to be applied are quite numerous or complex, it is much cheaper to use the second type; accordingly a transparency is always printed and used.

When the compiler is using a buff copy, the photographs are placed in an automatic focusing projector to correct the scale difference. Photography normally varies from a scale of 1:10,000 to 1:30,000. Ninety-five per cent of the charts corrected from aerial photographs are of a 1:40,000 scale, or larger; and the major portion of the balance is at 1:80,000 scale. Practically no trouble is encountered in transferring information from the photographs to the base. Previous compilation experience is a considerable help to the compiler in properly orienting the photographs for the best possible fix. At this point the compiler uses an electric erasing machine to delete unwanted or extraneous detail. If the area involved is not heavily congested, he may be able to add new detail or make the necessary corrections immediately with ink. Usually, however, there are so many changes that inking would cause too many smears. So the corrections are accurately made with thin lead pencil and later inked to better advantage with the chart spread on a drafting table.

When corrections are applied to a transparent plastic copy of a chart, much time is saved in erasing alone. On the buff copy much of the surrounding detail is damaged even when an erasing shield is used, and must be replaced in the same color ink, whereas, on the plastic even the tiniest item may be deleted with a scratch knife. The major times-saver, however, is that the photographs can be ratio-printed to the same scale as the chart, Then these photos marked up for correction can be placed under the plastic copy and oriented and detail removed or added directly. Consequently, this second type of chart copy is rapidly replacing the buff copy.

In some instances the corrections cannot be made directly from the photographs to the chart drawings. The basic planimetric or topographic maps of the area are first corrected and the corrected map drawings are applied to the chart drawings. This procedure is necessary in locating aids to navigation and landmarks, and also where the changes are so extensive as to require a photogrammetric plot for accurate positioning of the new details. A red or blue-line print of the base map is made on transparent plastic sheet-

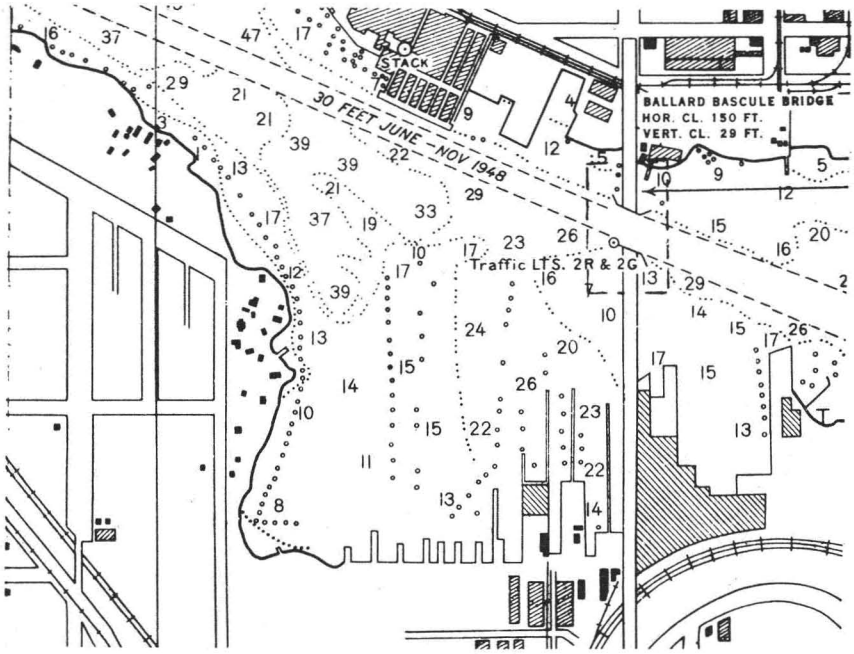

FIG. 1. Section of a nautical chart as it appeared before revision.

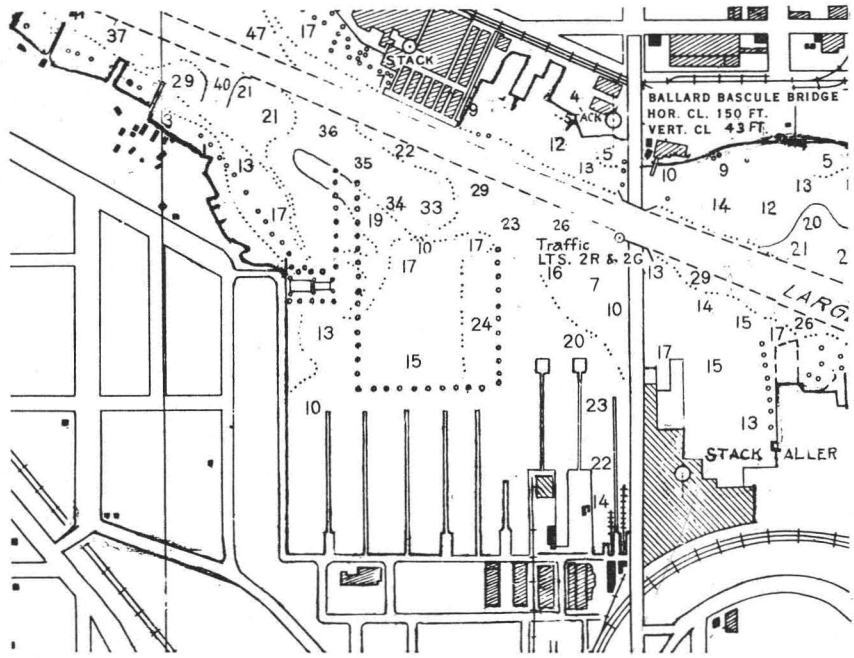

FIG. 2. The same map section, as shown in Figure 1, as it appeared after it had been revised by means of aerial photographs.

ing (vinylite or mylar) from the glass negatives of that map. This print is then used as a manuscript on which the revised details are drawn in black. The map revision may be done by graphic methods in flat areas, that is, by means of a radial plot and graphic delineation of details; in hilly areas stereoscopic instruments are used. The base maps are not completely revised for this purpose, but are used as a vehicle for obtaining the necessary corrections for charts.

A recent innovation in chart revision is the use of plastic scribing instead of drafting, where the revision reaches major proportions. After film positive copies of the basic planimetric or topographic maps are corrected from the latest photography, they are mosaicked on a controlled base. A blue line impression on yellow-coated vinylite is produced from this mosaic at chart scale; this can be scribed in approximately one-half the time needed to draft it and with a end-product superior in every respect. Plastic scribing is the subject of a separate paper by J. J. Streifler appearing elsewhere in this series.

Occasionally, photographic detail is so difficult to interpret that a field inspection for clarification is necessary. This condition is most commonly found in congested port facilities. A field party is dispatched to the site to make a thorough investigation and is supplied with a copy of the chart containing the corrections made by the compiler and photographs covering all the questionable areas. Upon completing the field work these data are returned to the compiler for application to the chart drawing. See illustration.

Illustration—Seattle, Washington. While the shoreline and large piers were readily discernible on the photographs, the small piers and piling in this area were almost completely obliterated by log booms, houseboats and smaller craft. Field inspection afforded the necessary clarification.

If a great deal of field work is to be done the supply of charts on hand may drop so low that it will be necessary to print a Tide-Over to bolster the supply until the chart is revised. This is a small reprint of the current issue without change.

Photogrammetry and the Safety and Regulation of Commercial Aviation

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ABSTRACT: *The Bureau's part in the compilation of airport approach and landing charts is described. The compilation and function of the present airport obstruction program is presented, including the special methods being utilized.*

THE practicing photogrammetrist, following the main highway of his science, is aware of many interesting byways which he probably has never had the time to explore. One such byway, which might not be familiar to him, is the role photogrammetry plays in the safety, reliability, and Federal regulation of commercial aviation.

Rules based on Civil Air Regulations and issued by the Civil Aeronautics Administration are mandatory and must be complied with by scheduled interstate air carriers, a category which includes the well-known air lines. In addition to covering the many phases of airline operation to which photogrammetry could have no relation, these rules require the airlines to prepare and keep current a manual for the use and guidance of flight and ground operations personnel. The minimum contents of this manual are specified and, as an example, must include, information on en route flight navigation procedures. This means that, among other things, the geographic positions of a multitude of electronic aids to navigation must be determined so that references to them can be included in the manual.

The role of photogrammetry thus begins