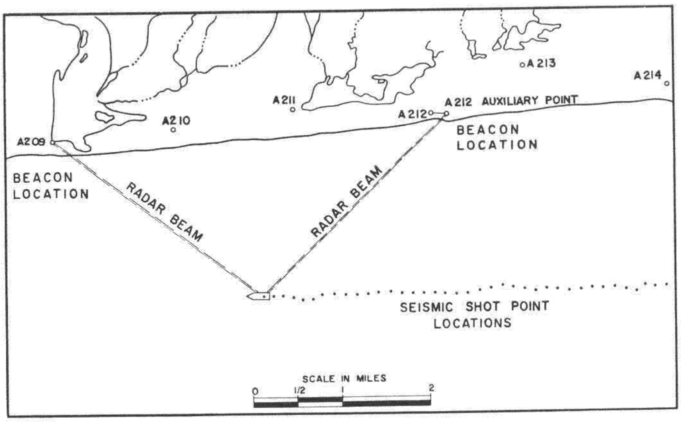

FIG. 3. Location of Radar Beacon Positions with the Kelsh Plotter. The location of points A209 through A214 was established on the base map by a Kelsh Plotter. Only points A209 and Auxiliary Point A212 were used as Radar Beacon Positions.

point was also plotted on the base map. The installation crew had a sufficient number of points from which to choose, and no serious problems in photo-identification were encountered.

With the positioning of the beacons, the radar-equipped ship was able to move along the coast. By taking a radar fix on two of the beacons at pre-determined time intervals, the radar operator was able to locate the position of each shot point and to plot it on the base map with precision well within the accuracy requirements of the job. The method of establishing the locations of the beacons proved to be very successful. By using the Kelsh Plotter it was possible to insure fast and accurate results.

These are only a few of the uses that have been found for photogrammetry in the search for oil.

Mosaics You *Can Make*

DAN MEYER

ABSTRACT: *Photo mosaics provide a wealth of pictorial detail that no map can equal. This paper describes a simple method of making uncontrolled mosaics.*

INTRODUCTION

A MOSAIC is an assembly of individual photos which have been trimmed and matched to form a continuous photographic representation of a large area. Mosaics are particularly useful in studying certain natural resources where a comprehensive view of an entire area is needed for a better understanding of any given part (e.g., geological formations, forest types). Construction of the more sophisticated controlled and semi-controlled mosaics requires specialized equipment and highly trained personnel, but useful uncontrolled mosaics are not difficult to make and are well suited to "home construction." Like the more refined techniques the "home construction" method utilizes only the center portion of each print where there is the

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FIG. 1. Construction materials: metal straight edge, grease pencil, knife, whetstone, rubber cement and dispenser, masking tape, cardboard and photos.

least distortion. But the scale in resulting mosaics is never uniform enough to permit precise measurements of distances or areas. Normally, these mosaics supplement, rather than replace, controlled planimetric maps.

PROCEDURE

The following is a description of the procedure developed at the Yakima Indian Agency. The mosaics are butt-joint assembly and are not rephotographed but used "as is" upon completion for both field and office forest management work. The finished mosaics are approximately 15″×30″ and represent half-township blocks. The average construction time is eight man hours. Basic contruction equipment and materials are pictured in Figure 1.

The single-weight contact prints (1:12,000) used by the contractor to make the index mosaics were requested at the time of photography, and were furnished for the cost of packing and shipping. (Several days were required to remove the staples from the photos and file them by flight line and number, however.)

INITIAL LAYDOWN

From existing map references, the township corners are located on the index mosaic, and the flight lines comprising the North half of the township are determined and fitted together with masking tape. (If the photography had been flown North and South, mosaics should be made in East and West half blocks.)

The center flight strip is laid first, giving careful attention to matching the detail in the center of the overlap area. Matching all the detail in the overlap area is rarely possible and is not necessary because matches will be made only in the center of the overlap areas.

The photos of the adjacent strips are fitted together in similar manner giving priority to endlap detail, but also matching sidelap detail as closely as possible. Close matches are important only in the center of the overlap areas.

Occasionally, a photo having noticeable tilt, marked contrast difference, or excessive overlap is encountered and should be omitted from the laydown if possible.

DRAWING MATCH LINES

All match lines are made with a straight edge. Such lines result in more obvious mismatches in the finished mosaic, but they are the easiest for the inexperienced worker and do afford a measure of final adjustments before mounting.

A red grease pencil is most satisfactory for drawing match lines. The marks are easily erased and the emulsion is not damaged by the soft pencil.

The sidelap match lines are drawn first. They are placed along the center of the sidelap area in what would represent the average sidelap for the strip. The lines are straight and continuous, but are rarely parallel to the photo edges. (See Figure 2, "A") The endlap match lines in the center strip are drawn next ("B", Figure 2), followed by the endlap match lines in the adjacent strips ("C", Figure 2). The endlap match lines are usually parallel to the photo edges and drawn near the center of the endlap area. Exact positioning will depend on the photo detail. For instance, lakes, drainages, roads or regularly shaped openings shouldn't be transected if they can be avoided by merely shifting the line one way or the other. Moreover, match lines should be kept within the same vegetative type whenever possible. An effort should also be made to stagger endlap line junctions along the sidelap match line. (See Figure 2)

CUTTING

The mosaic is now taped to a piece of plywood and made ready for cutting. Once the cutting has been begun, the mosaic must not be moved. Therefore, it is important that it

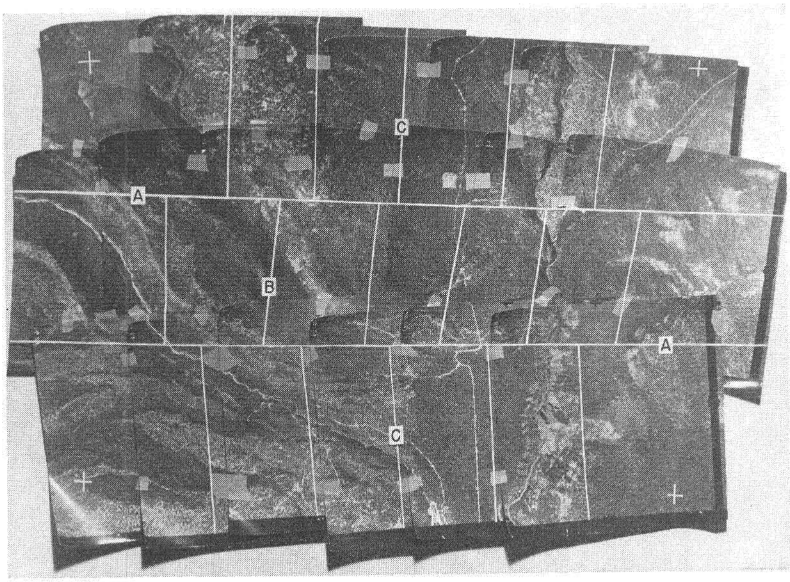

FIG. 2. Initial laydown and match lines.

be firmly attached to the cutting surface, and that the individual photos are fastened securely to one another. Cutting cleanly through several thicknesses of photos requires a sharp knife and considerable pressure. A knife with a stout handle and replaceable razor-type blades is recommended. (Figure 1)

Cutting of the match lines is done in the reverse order: endlap match lines of outside strips being first ("C"), endlap match lines of center strip next ("B"), and sidelap match lines last ("A"). (See Figure 2)

After the cutting has been completed, the center portion of each print is retained, and all the centers are taped together. The

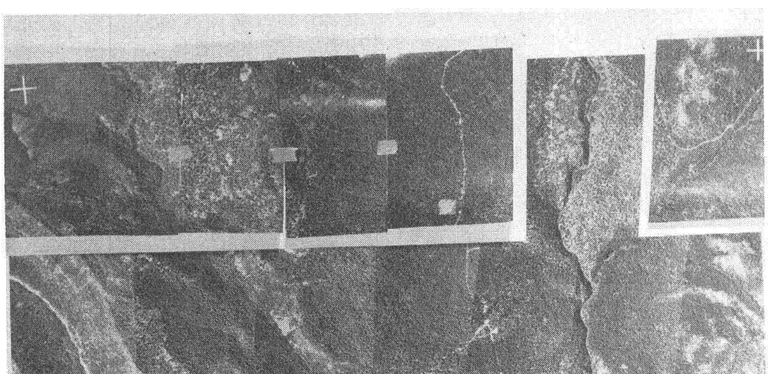

FIG. 3. Cementing photo centers.

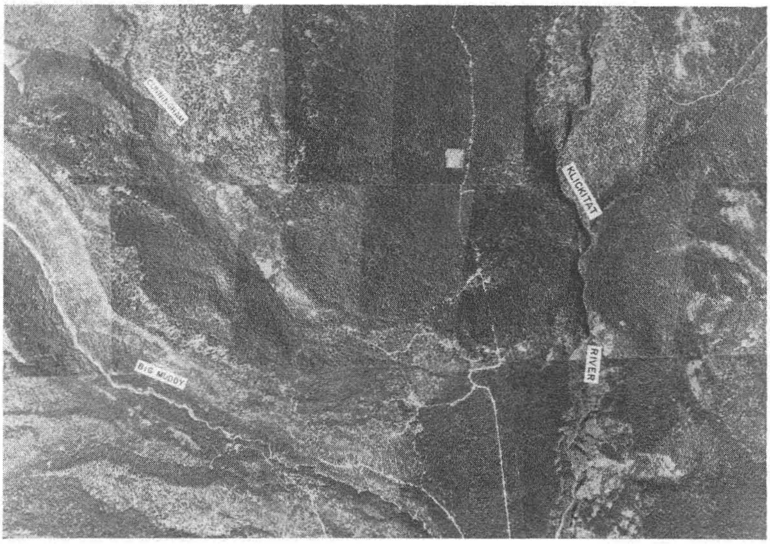

FIG. 4. Finished mosaic (note 10 acre clearcut plot adjacent to road).

fiducial marks help to identify the unwanted photo edges. (Even these shouldn't be discarded if there is a possibility of using them in training sterograms.) To prevent confusion it is advisable to note the strip and photo number on the reverse side of each photo-center as it is taken up.

MOUNTING

After a careful examination is made of the taped photo-centers, the mosaic is ready for mounting. The center strip is mounted first. (Figure 3)

A thin coat of rubber cement is applied to the back of the print and to the area it will occupy on the mount (cardboard). It is allowed to dry thoroughly. Because the print cannot be shifted once the cemented surfaces touch, a special technique is used. The print is held vertically and at right-angles to the previously cemented print. While maintaining pressure along the match line, it is slowly lowered into position and then rubbed firmly.

When the entire center strip has been cemented, the sidelap photo containing the principal detail of the mosaic (highway, river, etc.) is next cemented. If this detail is sufficiently important an exact match may be secured by shifting the entire sidelap strip. Similarly, if some important detail has been duplicated in one of the endlap matches, it may be cut out easily because these small adjustments can be taken up in the adjacent strips. The importance of straight match lines is clearly demonstrated, for no final adjustments could be made if free-hand lines were used. A certain amount of mismatches are bound to occur because of the difference in photo scales particularly between flight strips. Usually final adjustments are minor and worthwhile because they greatly improve the appearance of the mosaic.

FINISHING

When the cementing has been completed the mosaic is trimmed to final size to match adjacent mosaics. It is often difficult to obtain even moderately good agreement between township halves, in rough topography. (The maximum vertical or elevation difference in the sample mosaic shown is 2,000 feet in less than two miles.) However, this should not discourage the use of such mosaics in rough terrain because the working photo area has still been increased more than five times. In areas of more gentle topography, good agreement is nearly always obtained between township halves, and very often between townships.

The final step in the construction process is to label the outstanding features and landmarks. The amount of labeling will depend on the use intended, but as a general rule it should be kept to a minimum. Too much labeling merely duplicates planimetric maps, and obscures the detail the mosaic is intended to show.

If the mosaic is to be used in the field it is a good idea to keep it in a plastic jacket or to spray the mosaic with a plastic lacquer coating.

Conclusion

In conclusion, uncontrolled mosaics are useful in bridging the gap between individual aerial photos and controlled planimetric maps. If suitable prints can be obtained inexpensively and if uncontrolled mosaics will suffice, the method described in this paper may be used by inexperienced personnel and attractive, low cost mosaics obtained.

Author's Note: The author is indebted to BIA foresters, Harry McCarty and Stein Williams for their assistance in developing the above program at the Yakima Indian Agency.

Book Review

Electronic Surveying and Mapping. The Ohio State University, The Graduate School, Publication of the Institute of Geodesy, Photogrammetry and Cartography No. 11. Dr. Simo Laurila, Associate Professor of Geodetic Science. 294 pages. Price $6.00. Order from Ohio State University Press, 164 W. 19th Avenue, Columbus 10, Ohio.

The significance of electronic surveying and mapping methods has rapidly increased in the recent years. Consequently, an integration of these methods into a comprehensive teaching curriculum in geodesy and photogrammetry is today necessary. A sequence of regular courses in electronic surveying is already offered in the Department of Geodetic Science, The Ohio State University. In light of this development, the need arises to have available a textbook which covers in a comprehensive fashion the principles and methods of electronic surveying. It is the merit of Dr. Simo Laurila, who is a recognized specialist in this field, to have accomplished this task in a successful way and to write the first textbook on electronic surveying.

The content of Dr. Laurila's textbook is divided into three parts.

Part I [56 pages] represents a review of the fundamentals of electronics which are required to understand electronic surveying systems. The basic principles are well presented and excellent figures contribute to an easily understood text.

Part II [145 pages] of Dr. Laurila's textbook on electronic surveying is devoted to a comprehensive discussion of the various systems which are presently in use. General ideas of design, technical characteristics and attainable accuracies of these systems are discussed. Special consideration is given to "Circular Methods" (Gee-H, Oboe, Shoran, EPI); "Hyperbolic Methods" (Gee, Loran, Decca Raydist, Lorac) and other systems and instrumentation such as PPI Radar, Line-Scan Radar, Radio Altimeters, Tellurometer, Geodimeter, etc. Description and evaluation of the various systems and methods is clear and especially valuable for the practitioner.

In Part III [86 pages] special problems and applications related to electronic surveying systems are discussed. Items such as data reduction and the use of such data for geodetic purposes, error propagation studies, etc. are presented. Since a number of problems involved are still under investigation, this part is not presented with the same completeness as Parts I and II. A very comprehensive bibliography of 94 references and a glossary of electrical terms is appended to Part III.

It is doubtless that Dr. Laurila's work covers a gap in the field of geodetic science and it seems to me necessary that Laurila's textbook on electronic surveying and mapping should be in the book collection of everyone concerned with geodesy, photogrammetry and surveying.

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