THE WET PROCESS OF LAYING MOSAICS

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INTRODUCTION

THE Finnish procedure of aerial mapping was of particular interest to the writer at the Sixth International Photogrammetry Congress held at The Hague, Netherlands, September 1948. Colonel Lofstrom and Mr. Aarne Rainesalo, of the Finnish Delegation, donated much of their time to answering specific questions in regard to aerial mosaic mapping.

The underlying purpose of the Finnish method is the direct determination of the exterior orientation of the aerial camera as a means to keep ground control to a minimum. Two of the more important elements of exterior orientation are determined directly without the need of ground control. These two elements are:

(a) Relative tilt or variation of tilt between consecutive photographs.
(b) Relative flying height change or variation between consecutive exposure stations.

The relative tilt is determined by two small supplementary horizon cameras whose optical axes are fixed at right angles to each other. The components of the relative tilt are determined as a function of the inclination and displacement of the horizon lines relative to the fiducial axes of the horizon cameras. A statoscope records relatively small changes in the flying height. The images of the horizon and statoscope are recorded simultaneously on the same film, adjacent to the vertical exposure. Ground control at the flight ends makes it possible to determine the absolute tilt and flying height. The photographs are then rectified and ratioed to a common datum. Owing to the relatively flat terrain of Finland, the final map consists merely of a mosaic of the rectified and ratioed photographs adjusted to the ground control at the flight ends.

The above method is outlined primarily to emphasize the extent of Finnish efforts to control the accuracy of photographic orientation. It would be inconsistent to control each element and then lessen the accuracy in the final step by failure to control the dimensional stability of the rectified and ratioed photograph.

It is this final step, the wet process of laying mosaics, that is the subject of investigation in this report.

A. PURPOSE:

The purposes of this investigation are:
(a) To duplicate in detail the Finnish wet process of laying photographs.
(b) To evaluate the dimensional stability of the photograph after it is secured to its base.
(c) To note its adhesive properties to the base.

B. FACTUAL DATA:

Inasmuch as the actual process requires the use of a rectifier, Kodabromide projection paper was used in contact with a glass plate grid which served as a reference of known dimensions. This grid, 170 mm.×170 mm., consisted of a perpendicular system of finely scribed lines 5 mm. apart.

Three different specimens were prepared under the following conditions:

(a) Specimen A:
   (1) Dry contact printed.
   (2) Normally processed and air dried.
   (3) Adhered to base by paste.

(b) Specimen B:
   (1) 30 minute immersion in water.
   (2) Wet contact printed.
   (3) Normally processed and air dried.
   (4) Adhered to base by paste.

(c) Specimen C:
   (1) 30 minute immersion in water.
   (2) Wet contact printed.
   (3) Normally processed and air dried.
   (4) 20 hour immersion in a 1:1 solution of glycerine and water.
   (5) Adhered to base only by glycerine solution of previous bath.

The outside dimensions of the 170 mm. square grid imaged on the photograph were measured one month after laying and were found to be:

Dimension	*Specimen A*	*Specimen B*	*Specimen C*	*Grid*
Top	170.0	168.8	169.8	170.0
Bottom	169.8	169.2	169.8	170.0
Right	171.7	165.5	169.8	170.0
Left	171.2	165.0	169.8	170.0

C. CONCLUSIONS:

It is apparent from the tabulation of dimensions that Specimen C (Finnish Wet Process) resulted in the most favorable condition of dimensional stability. Uniform shrinkage along both axes of approximately 1 part in 1,000 can be compensated by an enlarging ratio of 1.001. Actually, however, in practice the Finns lay a trial mosaic and adjust the error of closure by revised ratio factors uniformly distributed between the ground control at flight ends. The final mosiac is then laid in conformity to the ground control.

One of the reasons for the bulk of the dimensional change for Specimens A and B is the necessity of "squeegeeing" the excess paste between the photograph and base. This stretches the photograph along the direction of application of the squeegee. This is not required for Specimen C, since the glycerine-soaked print is laid flat and the excess solution blotted.

In contrast to a pasted print, the glycerine-soaked print allows its removal or adjustment with a minimum of effort and as many times as required. Glycerine, being hydroscopic, absorbs water and the photos are wet or damp for many months. The photos adhered sufficiently under the following conditions:

(a) To each other in an overlapped position.
(b) To masonite.
(c) To aluminum.
(d) To aluminum backed paper.
(e) To glycerine soaked newspaper on masonite and aluminum.

Inasmuch as the mosaic is usually copied soon after it is laid, there is little chance for photo disturbance. Regardless of the elapsed time prior to copying, the photos will adhere for many months if given reasonable care and handling.

The wet process is recommended only when its accuracy is consistent with the rectification and ratioing data of the photography. It would not be feasible to use the wet process with photographs that were not rectified or ratioed. Azimuth and position displacements would cause a change of scale from one photograph to the other, thereby restricting a reliable extension of the photographs. The added refinement of the wet process, in this case, would not materially aid the accuracy in the final mosaic, since the initial elements of orientation were not compensated or rigidly controlled.

NEWS OF PHOTOGRAMMETRISTS

Effective April 24, *Mr. R. O. Anderson* terminated his work as Photogrammetric Mathematician at Chattanooga, Tennessee and was transferred to Washington, D. C., where he is in the Photogrammetric Section of the Naval Photo-Intelligence Center.

John E. Meyer has resigned from his position of Sales Manager of the Abrams Aerial Survey Corporation and is now Photogrammetric Engineer with the Michigan State Highway Department.

Lt. Col. Albert William Stevens, famed as a balloonist and well known for his aerial photographic work, died on March 26, at Redwood City, California. He was 63 years old. Col. Stevens was the holder of the world's record for stratosphere free flight; the record ascent to 72,395 feet was made on November 11, 1935 from Rapid City, S. D. in the sealed gondola of Explorer II. An attempt in 1934 nearly ended in disaster due to disintegration of the balloon beginning at 60,000 feet and explosion of the gas bag at 3,000 feet. In aerial photography, Col. Stevens developed a technique with infra-red sensitive film that enabled him to take pictures of mountains 200 miles and more away. In 1930, he also made the first photographic record of earth curvature, using infra-red film, showing the Andes Mountains 287 miles distant. In 1932, he photographed the total eclipse from an altitude of 5 miles; the photo, which is understood to be in the Washington Office of the National Geographic Society, shows the shadow of the moon advancing darkly across the earth and clouds. In 1937 Col. Stevens was a member of the Hayden Planetarium eclipse expedition in South America. A graduate of the University of Maine, which gave him a degree of doctor of engineering in 1909, he engaged in electrical and mining engineering operations prior to his service in the Signal Corps during World War I. After the war's end, he remained with the Signal Corps, took part in making the first large photographic mosaic in this country, was later assigned to McCook Field and in 1937 became director of the Army Aeronautical Museum at Wright Field. Col. Stevens' inventiveness and experiments contributed much to the development of the technique of photogrammetry, the design of airplane cameras, and apparatus for studying the stratosphere.

Dr. Philip Smith, retired Chief of the Alaskan Branch of the U. S. Geological Survey, died on May 10. Widely known as a geologist, Dr. Smith remained active in scientific work even after his retirement three years ago. He was a graduate of Harvard, where he taught geology and physiography from 1900 to 1906 when he joined the Geological Survey. He held important positions with FEA and at the 17th International Geological Congress in 1937. Dr. Smith was the author of numerous reports and papers on geology and was a member of many organizations. He joined the American Society of Photogrammetry in 1946 and was a member at the time of his death.

Norman C. Smith in February, left the employ of Humble Oil & Refining Co., Tulsa, Okla. to organize the Western Photo-Geological Co., 811 South Boulder, Tulsa.

RESOLVING POWER

Semi-Annual Meeting of the American Society of Photogrammetry: see announcement on page 198.

Misidentification: On page 138 of June issue, 4th line from bottom. Change Cote to Miller.

Correction: On page 133 of June issue, change Pears to Pearce, and add Col. C. C. Lindsay, Montreal, Canada.