Use of the Aerial Photograph

George R. Muth

Nov. 24, 1948

Pro Seminar
Prof. Lohr
Aerial photography is a tool that has great potentiality in the pursuit of Civil Engineering. This morning I should like to discuss some of the applications of the aerial photograph, and the information that can be gleaned from their study.

The fundamental idea in any surveying operation is the measurement of horizontal and vertical distances. The large amount of labor and time that is consumed by using conventional methods of surveying can be cut down by the use of aerial surveying techniques.

First, the question of horizontal measurement arises. Can horizontal distances be measured from an aerial photograph?

The diagram shows two similar triangles. The lens of the camera converges the rays of light reflected from the earth.

(A) in the above drawing is known, it is the altitude of the lens, (I) is the length of the image which can be measured and (F) the focal length of the lens which is known.

(G) is the horizontal distance desired and it is readily apparent that it can be solved for by simple geometry.

If the altitude is not known but a distance on the ground is known the same simple proportion will give the answer.

This proportion is \[ \frac{I}{F} = \frac{G}{X} \]
The proof that vertical distances can be computed is complicated but I shall show you that it works on the same principle as the stereopticon.

The stereopticon uses two adjoining photographs taken at a set distance apart. The eye adjusts for the difference in point of view that these two photographs present and an illusion of depth is given.

The angles of view that are presented in these photographs can be measured and the relative elevation of various points on the photograph can be ascertained.

The fundamentals of mapmaking are simple. Say a large area is to be mapped.

Flight lines are set up so that there is a side overlap of photographs of 40%. (These lines are AB, CD, Etc. On the drawing) This overlap is easily computed as the altitude to be flown is known, the focal length of the lens is known and the size of the film is known. Therefore the the amount of ground covered can be computed as shown previously.
There is usually a general map available to give points where
lines of flight should be started in order to get the 40% overlap.

When a map is not available one can use a ground glass etched
as a grid as shown in the sketch. A lens causes an image on the glass.

An object is picked up on one of the lines that is in the
same direction as the line of flight and this follows on the ground
glass in the direction of the line of flight. On the next pass
over the area this original object is offset the required distance
for proper overlay and another object is picked up for offsetting
on the third pass.

For overlap in the other direction an object is picked up
on the ground glass and the time interval is noted for the object
to travel the required distance on the ground glass. An interval
timer is then set for this time and a continuous series of pictures
is taken.

After the photographs are processed they are laid on a board
so as to present a general layout of the terrain. This layout
is called an uncontrolled mosaic.

For accurate work a system of known points must be available.

For example a system of Coast and Geodetic bench marks can
be used. These can be located in relation to each other and the
errors between them can be averaged out. Since the relative eleva-
tions can be gotten from a photograph there must be some known
obtained.
elevation to carry the actual elevations from, known bench marks give known elevations and by this method contour maps can be developed.

In a recent edition of the Philadelphia Inquirer (This article is enclosed) an article appeared telling of the Marine Corps landing at Roche Point, Newfoundland in a mock invasion.

This article went on to say that the Department of Civil Engineer at Cornell, under Dr. D. J. Becher, disclosed the following information about conditions that would be encountered. This information was gotten solely from aerial photographs. Part of the analysis was based on geo-morphology. Geo-morphology is the science dealing with the relation of land form to sub-structure.

The type of beach was predicted (this prediction included the fact that trucks could successfully operate on the beach. (The lack of information about the use of motorized equipment at Iwo Jima with respect to the inability of the beach to support this equipment cost 20,000 wounded and 4,000 lives.), the depth of water was predicted also the drift of the tide was predicted.

This article continues by saying that by these methods there is a tendency to eliminate such things as test borings for sub-soil drainage, for heavy duty traffic, landslide possibilities and generally help solve other similar problems.

Furthermore flash floods can be predicted, borrow pits can be located most economically and the type of material in the borrow pit can even be specified.

I have tried to outline rather briefly the use of a new tool in Civil Engineering, and I hope that I have succeeded in demonstrating that aerial photography is an aid that bears personal investigation.
Science Takes a Beachhead
Experts Map Landings From Air Photographs

By John M. McCullough

The scientists, none of them a member of the armed forces, told the Marine Corps precisely in detail what kind of beach the assault landing team would encounter when it stormed shore inside Rocha Point at Argentina, Newfoundland, in simulated "cold winter" amphibious operations last Monday.

This prediction of beach conditions was made hundreds of miles distant from harsh and barren Argentina on a quiet office of Cornell University's Department of Civil Engineering, solely upon the basis of aerial photographs.

The same predictions accurately supplied, would have warned the Marine staff which planned the invasion that field radio communications would be almost impossible, because of the high reflection of low-power, high-frequency radio waves by the rocky

Continued on Page 3, Column 3.
Air Photographs Depict Terrain

By John M. McCallough

AFTER considerable preliminary study of the photographs, one was sent to the Department of Civil Engineering of the University of Illinois, where A. E. Beighler is head. His two assistants in the work are R. A. McNeely as the "official surveyor" in the "beach" and civil engineering department and R. C. Eames, both of whom are research assistants.

Working solely from aerial photographs of the Argentia beach and the surrounding terrain, Dr. Beighler and his assistants advised the Marine Corps that the beach would be composed of water-smoothed glacial debris, principally granite and varying in size from very fine to large. It was predicted that heavy equipment, bulldozers, graders, steam shovels, etc., could be moved easily up the beach. The beach was found to be "sandy" in the sense of being composed of sand. Its color was gray, and it varied in size from fine to coarse, depending on the area. It was also found that the beach was about 200 feet wide, and that it would be possible to move heavy equipment up the beach without difficulty. The beach was found to be "sandy" in the sense of being composed of sand. Its color was gray, and it varied in size from fine to coarse, depending on the area. It was also found that the beach was about 200 feet wide, and that it would be possible to move heavy equipment up the beach without difficulty.

The photographs were used to determine the best way to move equipment up the beach. The best way was found to be to use a combination of sand and water. The sand was spread over the water and the equipment was then moved up the beach. The water was then drained off and the equipment was moved up the beach again. This process was repeated until the equipment was at the top of the beach.

The photographs were also used to determine the best way to move equipment across the beach. The best way was found to be to use a combination of sand and water. The sand was spread over the water and the equipment was then moved across the beach. The water was then drained off and the equipment was moved across the beach again. This process was repeated until the equipment was at the top of the beach.

The photographs were also used to determine the best way to move equipment from the beach to the sea. The best way was found to be to use a combination of sand and water. The sand was spread over the water and the equipment was then moved from the beach to the sea. The water was then drained off and the equipment was moved from the beach to the sea again. This process was repeated until the equipment was in the water.