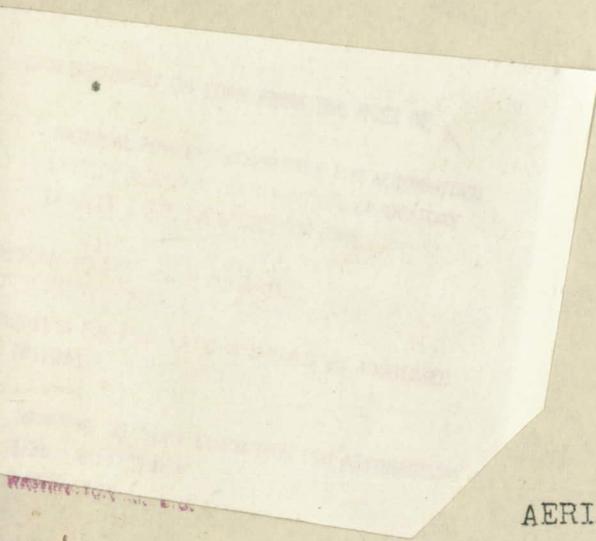


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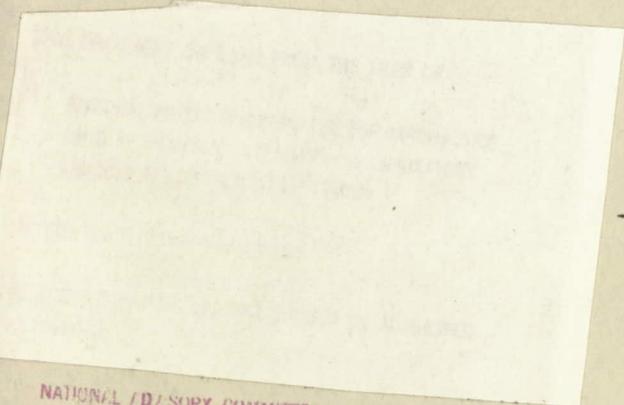


No. 200

AERIAL PHOTOGRAPHY

Obtaining a True Perspective.

Taken from London Times, April 5, 1923.



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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
1724 STREET, N.W.,
WASHINGTON 25, D.C.

April, 1923.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

TECHNICAL MEMORANDUM NO. 200.

AERIAL PHOTOGRAPHY

Obtaining a True Perspective.

A demonstration was given within the last few days at the British Museum by Mr. J. W. Gordon, author of "Generalized Linear Perspective" (Constable and Co.), a work describing a newly-worked-out system by which photographs can be made available for the purpose of exactly recording the dimensions of the objects photographed even when the objects themselves are presented foreshortened in the photograph.

Everybody is aware that the laws of perspective enable an artist to depict with due regard to appearances a view in which a mile of roadway appears compressed into a space no greater than is occupied in the same picture by the wall of a cottage standing by the wayside, and to do so with such mathematical correctness that a visitor to his studio can make a shrewd guess as to the length of the road. If the visitor be sufficiently instructed in the rules of perspective, he will be able actually to measure up that foreshortened road, given certain data from which the artist has worked.

The laws of perspective apply to photographs just as to drawings, and indeed a photograph taken by a well-corrected lens is more rigorously true to the laws of perspective than even the most carefully made drawing. Hence it has long been an object with

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land surveyors to effect their surveying by means of photographs and so save an immense amount of labor in the taking of observations by theodolite and level. This is very specially the case in military reconnaissance, where the surveying of enemy positions is accompanied by formidable risks to life and limb. Hence the question of using photographs for land survey became a question of most pressing urgency during the war, which was anxiously studied by the cartographic departments of all the belligerent armies.

Photographs from the Air.

But it was found that the known rules of perspective are of no practical use for dealing with photographs taken from the air, for the simple reason that such photographs exhibit the bird's-eye view of the country and not that of a terrestrial creature. The bird looks down at all sorts of angles and must be quite familiar with the roofs of houses and the tops of trees, whereas the human observer looks into nature with a level gaze, seeing walls where the bird sees roofs, and foreshortened paths and levels where the bird sees objects displayed as on a map or plan. It turned out during the war that the theory of perspective as elaborated in the art schools is quite inadequate to the interpretation of bird's-eye pictures, and in the end the soldiers gave up trying to plot maps from such pictures and sent their photographers over the enemy territory to get "vertical" photographs, which needed little or no plotting, for they are practically ready-made plans.

The experience of the war made land surveyors, whether mili-

tary or civil, all the world over, keenly anxious to solve the problem of bird's-eye perspective, in view of its great practical importance. It may be taken that this problem has engaged the attention of a great many investigators scattered all over the world. The first person to publish, indeed, the first even to announce, the solution of the problem and to give to our science the rules of bird perspective, or, using its scientific name, of "generalized linear perspective," is an Englishman whose work has just been presented to the public by Messrs. Constable and Co. Mr. Gordon speaks of his as the first book on this important subject to appear in any language.

Eighteenth Century Discovery.

The mathematics indeed of generalized linear perspective have been discussed before, and a very notable book on the subject was published in 1715 by a distinguished English mathematician, Brook Taylor, at that time the secretary of the Royal Society. Brook Taylor's book was, however, very severely mathematical. It contained no working rules, and unfolded no practical system of producing perspectives. Several later writers undertook to supply the lack and, starting from Brook Taylor's pioneer work, they developed the body of rules which to this day are taught to art students, architects, and others for the production of perspective drawings. But those systems, without exception, relate to the level perspective of the human-eye view of the world. So completely had the bird's-eye view passed out of knowledge that in fact the

whole subject was worked out by the present author in 1920 in ignorance of what Brook Taylor had done two hundred years ago.

An interesting story is told in the preface of his book of the chance discovery of Taylor's anticipating work when the new writer's manuscript was ready for the printer. That story affords a striking instance of the old law that scientific truth is often inestimably valuable when it seems most remote from practical demands, for here we have in Brook Taylor's book the bird's-eye perspective of the airplane photograph worked out in detail a hundred years before photography itself was invented and a hundred and fifty years before the first airplane took the air. It is little wonder that science so much before its time should have been forgotten when the great need arose for it in the Great War, and should have come to light only when, having been rediscovered, it became itself the object of historical research.

Applications of New Art.

The great emergency has passed, and the later author of the theory was calling attention on Wednesday last to one of the many minor applications of this new art. These, as he pointed out, are very numerous. Apart from the professional interest which artists and draughtsmen will take in the subject from its artistic side the architect will in future be able to produce "photographs" on his drawing-board and show to his clients the appearances, seen as in three dimensions, of his designs, of a design for a staircase, for example, as it would be seen from above, or for an entrance hall as

it would appear seen from a first-floor landing. The road surveyor and the land agent will be able to add as many contour levels as they desire to the Ordnance Survey map, and the explorer will record a whole infinity of measurements that he will work out at leisure and at need.

It was this last operation that was the object of last Wednesday's demonstration at the British Museum, given appropriately enough in the Egyptian Gallery there. The object selected was a group of statuary which once stood before a small Ptolemaic temple in Upper Egypt. Flanking this group are two Sphinxes, one on each side. In the background is the wall of the gallery. The group of statuary is so close to the Rosetta stone in the entrance to the gallery on the ground floor. To make the conditions of the problem difficult, as difficult as any that are likely to arise in practice, the photographer had arranged by leave of the Museum authorities to work from an elevated platform which gave him an oblique bird's-eye view of the group such as has been characteristic of many of the pictures from Luxor exhibiting first glimpses of the interior of Tutankhamen's tomb. The angle at which the photograph was taken was determined by clinometer and a foot measure placed on the floor of the Museum served as a gauge by which magnitudes in the photograph could be determined.

Two photographs were taken under these conditions from positions two feet apart, and by a comparison of these two photographs the whole situation in all its dimensions was reproduced. Our picture page shows one of the photographs marked with the parallaxer

scale by which it was compared with its companion photograph, and the ground plan and elevation show to scale the dimensions of the various items of the group as measured, not on the objects themselves, but on the photographs. Mr. Gordon tells us that if any of our readers care to verify the measurements, and the objects themselves are in the gallery and "plain for all folk to see," they will find that the dimensions have been ascertained within an inch of truth. In fact, we have it on his testimony that the errors do not exceed 1 per cent.

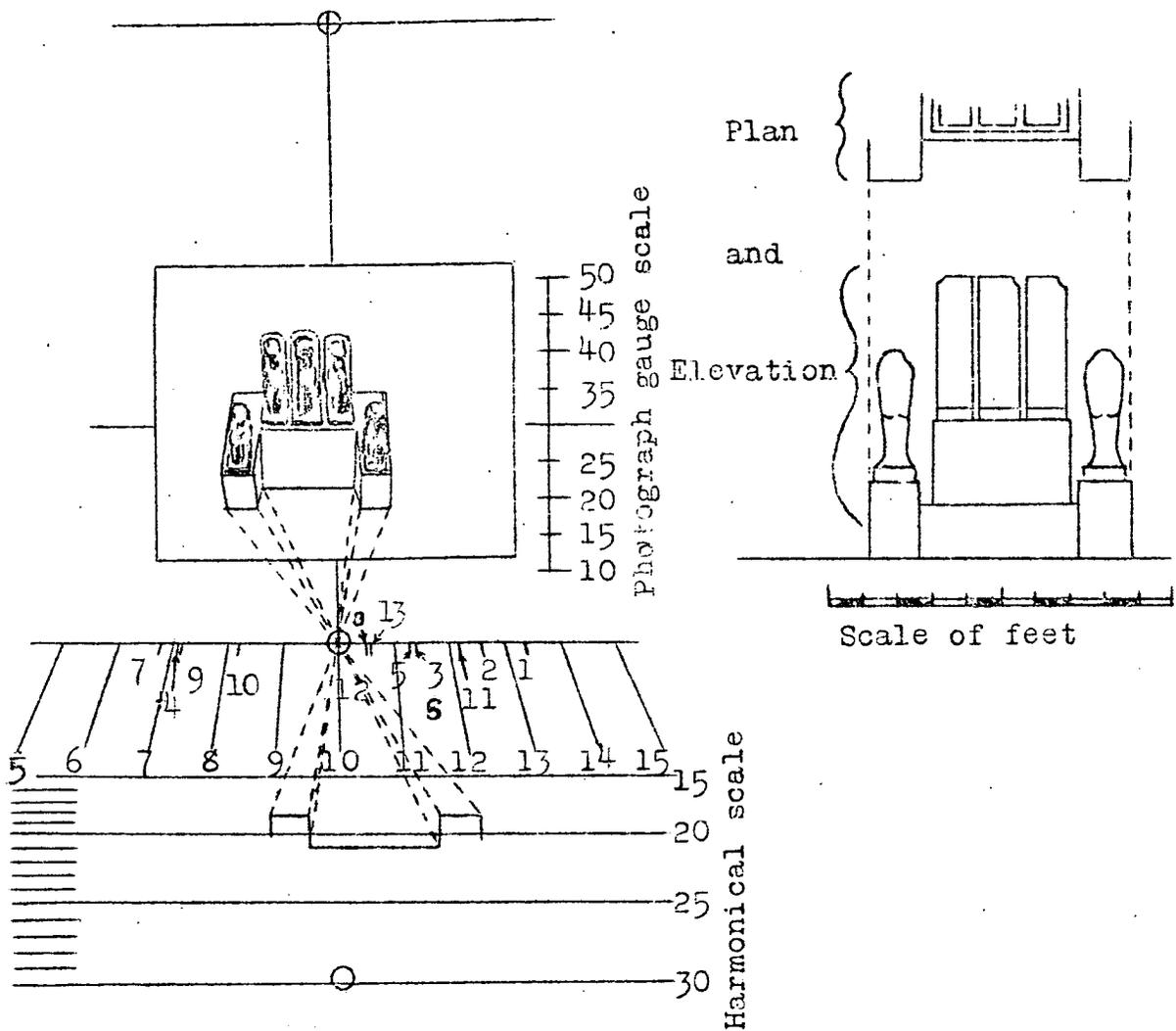


Diagram showing how the ground plan may be projected from the "field center". Right: A simple plan and elevation.