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TRANSLATION

ON THE ADJUSTMENT OF ARTIFICIAL EARTH SATELLITE POSITIONS TO STARS

By

B. N. Himmelfarb

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FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

WRIGHT-PATTERSON AIR FORCE BASE

OHIO

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By: B. N. Himmelfarb

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ON THE ADJUSTMENT OF ARTIFICIAL EARTH SATELLITE POSITIONS TO STARS

B. N. Himmelfarb

In the instructions for conducting visual observations of artificial earth satellites [1], a method was described for determining equatorial coordinates of the center of the field of view of tube AT-1 based on observations of the transit of stars across the lines of the reticle in the field of view of the tube. It ~~is~~ insufficient to adjust to the stars the position of the sputnik, whose intersections are made on the reticle since the slope of the lines of the tube reticle to the lines of the coordinate reticle on the star map remains unknown.

At the conference of supervisors of visual observation stations, of AES (Artificial Earth Satellites) in April, 1959, A. G. Sukhanov, supervisor of the Vladivostok station, described a method of adjusting the position of the AES to stars which was based on drawing the daily parallels of stars based on the observation of their transit through the lines of the reticle in the field of view of tube AT-1 and on determining the differences of the coordinates of these stars and the point at which the intersection of the sputnik was made [2]. This

method, which requires the use of a special orthogonal drawing scale, extractions of star coordinates from a catalogue or from a map, and some calculations was pointed out by many participants of the conference as too cumbersome. Meanwhile, the use of transparent graph paper representing the reticle of tube AT-1 in the scale of the star map, enables us to simplify this method and to obtain sputnik coordinates immediately from the star map without any such calculations. There are definite advantages to this method, namely:

1. Orientation of the reticle in the field of view of the tube relative to the vertical makes no difference, therefore we need not level the tube;

2. We need not know the coordinates of the center of the field of view.

3. It is sufficient that one or two stars be visible in the field of view of the tube, and while we need not know their coordinates, the stars must be discerned by some method and found on a map.

In order to adjust to the stars, it is necessary to observe either the transit of the same star through two different lines of the reticle in the field of view of the tube or the transit of two stars through the same or through different lines of the reticle. The substance of the methods in both cases is apparent from the following examples.

Example 1. Intersection of the sputnik was made at time T at point C on the vertical line of the reticle (Fig. 1). Transit of the star was recorded at time T_1 at point 1 of the horizontal line of the reticle and at time T_2 at point 2 of the vertical line. Time T_2 need not be recorded but knowledge of it is useful for control. Through points 1 and 2 we will plot on the transparent graph paper the daily parallel of the star (dashed straight line in Fig. 1). Then, finding

star A from the star map, whose transit was observed, we superimpose on the map the transparent coordinate reticle and over it the transparent graph paper (Fig. 2), so that point 1 coincides with the image of star A on the map, and line 1-2 is placed along the diurnal parallel of this star (which is easy to do visually by orienting along the neighboring parallels on the coordinate reticle). After this we read off the equatorial coordinates of point C along the coordinate reticle. Its declination is equal to the declination of the object, and we must add a correction equal to $T-T_1$ to the right ascension.

If the times were recorded by a printing chronograph then this correction is simply the difference of the corresponding prints on the tape of the chronograph (obviously, there is no need to change to absolute times). When using a stop watch with two hands, both hands are started at the instant of intersect T simultaneously, and at the time of adjusting T_1 the auxiliary hand is stopped, thus showing the difference T_1-T (in order to obtain a right ascension of the object at the moment of observation it is necessary to remove this difference from the right ascension of point C). If time T_2 was also recorded, we can repeat the procedure with point 2 as was done with point 1, and again obtain, for control, the coordinates of the object of observation.

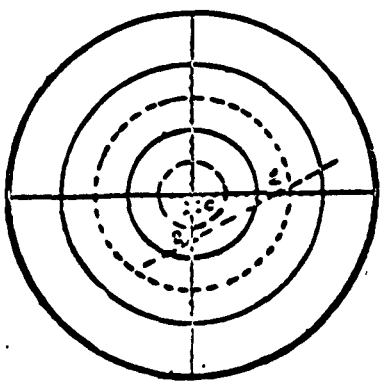

Fig. 1.

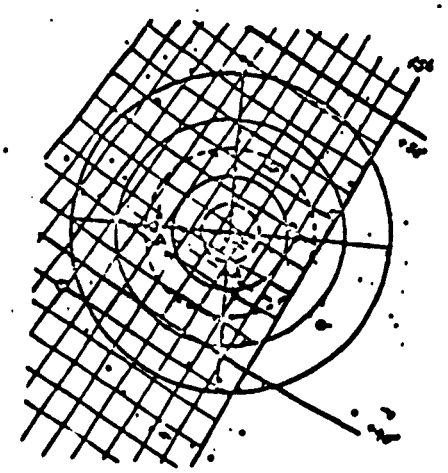

Fig. 2.

Since tube AT-1 gives a mirror image, it is necessary to superimpose transparent graph paper on the map of the Bec̆var̆ "Sky Atlas", having turned it over on the reverse side. When using reflection photocopy of star maps it is unnecessary to turn over the transparent graph paper.

Example 2. Intersection of the sputnik was made at time T at point C on the horizontal line of the reticle (Fig. 3). At time T_1 the transit of star A through point 1 on the vertical line of the reticle was recorded and at time T_2 transit of star B through point 2 on the vertical line of the reticle was also recorded. As in the first example we need not record time T_2. Now we superimpose on the star map the transparent coordinate reticle and above it the transparent graph paper so that point 1 coincides with the image of star A on the map and point 2 lies on the diurnal parallel of star B (we will draw this parallel through star B, using neighboring parallels on the coordinate reticle; in figure 4 it is shown as the dashed straight line). Then, we read the equatorial coordinates of point C along the coordinate reticle and correct the right ascension for the difference of time $T-T_1$ as in the first example. So, for control we can repeat the same procedure from point 2 if time T_2 was recorded. Point 2 need not be on the same line of the reticle as point 1, but this case does not differ in any way from the one described.

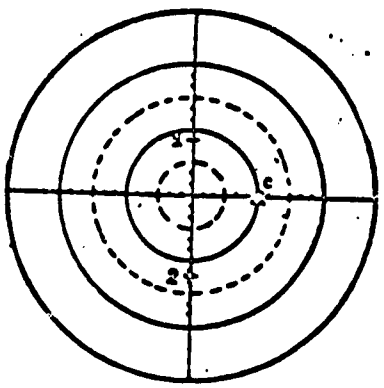

Fig. 3.

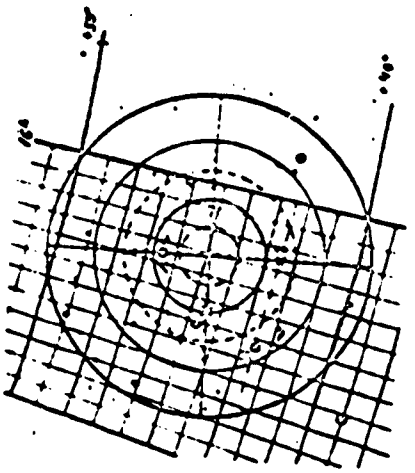

Fig. 4.

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2. Byuletten' stanysiy optichescovo nablyudeniya ISZ, 7, p. 1. 1959.

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