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TRACKING THE SATELLITE 1957 α2 »SPUTNIK I» BY MEANS OF THE FINNISH RADIOTHEODOLITE

by

VILHO VÄISÄLÄ

Institute of Meteorology, University of Helsinki

When the news of the first artificial Earth's Satellite reached us, we decided to convert one radiotheodolite, the usual working frequency band of which is 24—25,6 Mc/s to operate at the frequency 40 Mc/s of the Satellite This radiotheodolite is constructed for wind measurements in the free atmosphere by tracking the flying radiosonde [1,2]. Fig. 1 shows the recording receiver of the radiotheodolite in use by the Swedish-Finnish-

Fig. 1. Radiotheodolite receiver in use by the Swedish-Finnish-Swiss IGY Expedition on North-East-Land.

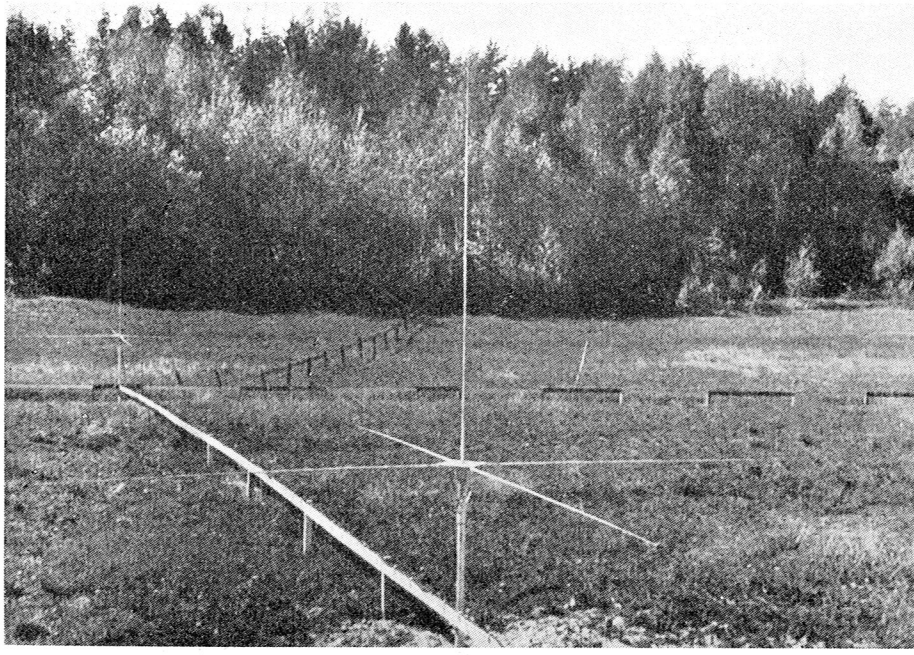

Fig. 2. Radiotheodolite antennas at the Testing Station of the Radiosonde Factory Vaisala Oy near Helsinki.

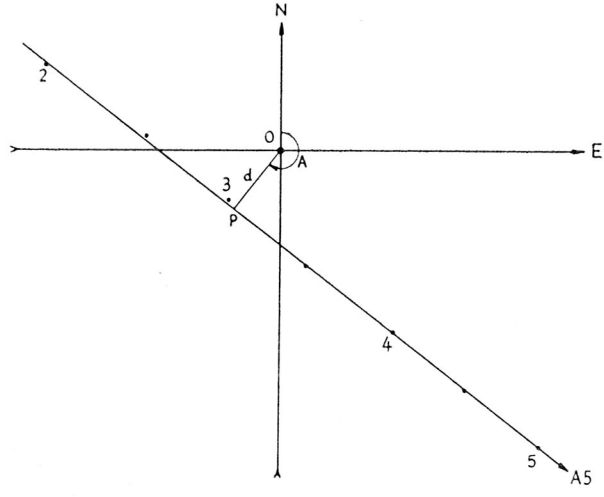

Fig. 3. The passage *A5*. The time interval of successive points is $^1/_2$ min.

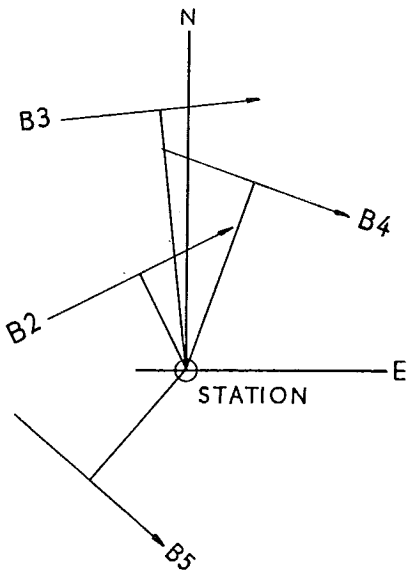

Fig. 4. The four passages during the night 11—12. Oct., 1957.

Swiss IGY Expedition on North-East-Land, Spitzbergen, and Fig. 2 two of the seven antennas at the testing station of the radiosonde factory VAISALA OY at Vantaa near Helsinki. Observations of the Satellite were made at the above mentioned testing station by means of the radiotheodolite. In the following, observations carried out during three consecutive nights, four passages of the Sputnik each night, are reported. Fig. 3 shows one of the tracked paths. The points marked are horizontal projektions of the Satellite positions at successive half minutes. In Fig. 4 the four passages during the night 11th—12th Oct. are shown. (Two more passages each night were observed but, because of the small elevation, not computed.)

The converting of the radiotheodolite to the frequency 40 Mc/s as well as the observations were made by Eng. M. WILSKA assisted by the writer. The computations were made by the writer.

It is not necessary in this connection to go into the details of the computations. Only the results may be reported here.

Coordinates of the station: $\varphi = 60.28°$ N, $\lambda = 1^h39^m40^s$ *E* Greenw.

Period of the observations: 10th—13th October 1957.

The consecutive nights are named by letters *A*, *B*, *C*:

Table 1. Satellite 1957 α2. Data of 12 passages in October 1957.

N:o	Day	t			A	d	H
		h	m	s		km	km
A2	10	23	15	12	329.6°	107	269
3	11	00	53	54	353·3	536	315
4	»	02	32	44	17.3	453	341
5	»	04	11	26	218.0	150	376
B2	11	23	13	00	333.2	210	269
3	12	00	51	25	353·4	520	323
4	»	02	30	22	19.2	398	356
5	»	04	08	52	220.6	288	378
C2	12	23	09	53	338.2	304	300
3	13	00	48	39	1.0	594	326
4	»	02	27	26	23.8	326	344
5	»	04	05	51	221.6	412	390

A = the night 10th—11th Oct. 1957
B = » » 11th—12th » »
C = » » 12th—13th » »

The four passages are numbered 2—5. Table 1 contains for each passage data of the path point (P, Fig. 3) where the path projection on the Earth's surface was nearest to the observing station (O, Fig. 3):

t = moment of the passage, Greenw. time + 2 hours,
A = azimuth of the point P. North = 0°, East = 90°,
d = horizontal distance (OP) from the station, km,
H = height of the Satellite above the sea level, km.

In table 2 the inclination of the orbit plane against the equator (in degrees) is shown, computed for each of the 12 passages. The mean error of the mean value 65°.40 is ± 0°.09.

Table 2. Inclination of the Orbit Plane.

Passage	2	3	4	5	Mean
A	65.3	65.3	65.5	65.7	65.45
B	65.4	65.3	65.6	65.2	.38
C	65.3	65.8	65.8	64.6	.38
Mean	65.33	65.47	65.63	65 17	65.40°

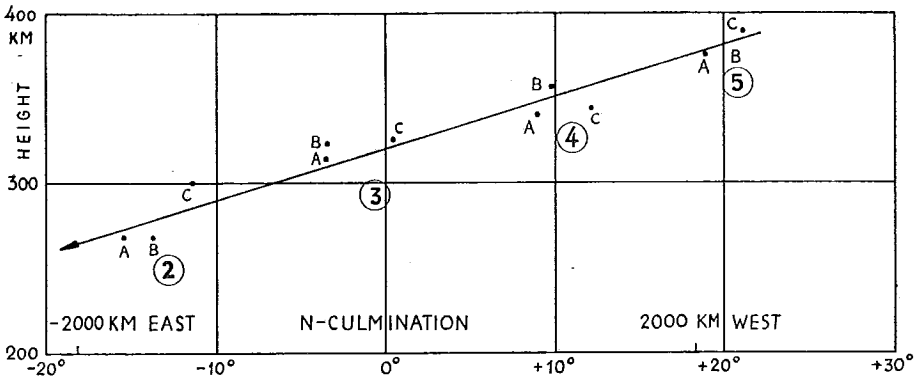

Fig. 5. The Satellite orbit in the neighbourhood of the North culmination.

The time of revolution of »Sputnik I» was calculated to 95.79 ± 0.01 min.

The height of the Satellite in dependence of the angular distance from the North culmination point is shown in Fig. 5. It presents in other words the course of the Satellite orbit in the neighbourhood of the North culmination.

REFERENCES

1. VÄISÄLÄ, V., 1953: A New Radiotheodolite. *Proceedings of the Indian Academy of Sciences*, 37, No. 2, Sec. A.
2. —»— and WILSKA, Y., 1956: A Graphical Method for Computing Wind Values from the Finnish Radiotheodolite Record. *Mitt.-Papers. Met. Inst. Univ. Helsinki* No. 78.