

# THE CONNECTION BETWEEN THE STRUVE GEODETIC ARC AND THE ARC OF THE 30<sup>th</sup> MERIDIAN

**J R Smith**

International Institution for History of Surveying & Measurement  
(A body wholly within FIG)

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## ABSTRACT

*As will be seen in the paper accompanying this one (The Struve Geodetic Arc), in July 2005 the Struve Geodetic Arc was inscribed on the list of World Heritage Monuments. As an extension to that monument it is feasible to locate in the same manner a southerly extension to the Struve Arc as far as Crete and a further arc – called the Arc of the 30<sup>th</sup> Meridian – on the south side of the Mediterranean Sea that continues down through East Africa to near Port Elizabeth. These short notes outline details of both the connecting triangulation, the crossing of the Mediterranean and the Arc of the 30<sup>th</sup> Meridian. It will be best read in conjunction with the Struve Arc paper.*

## BACKGROUND

In the Introduction to his volumes Struve wrote (translation from the French):-

*The arc between the mouths of the Danube and the Arctic Ocean can at this stage be regarded as the major part of an as yet unfinished task. In effect nature places no obstacle to the continuation of our triangles by an arc of nearly 12 degrees in a southerly direction towards the island of Crete, crossing continental Turkey and the islands of that Archipelago. Between Fuglenaes and Crete there are more than 37 degrees of latitude, which constitutes the European Meridian of the greatest possible extent, and at the same time this arc is the closest to the mean meridian of the continent of Europe which extends, west to east, from Cape Finisterre, longitude 8° 20' from Ferro to the town of Iekaterinbourg, longitude 78° 14'. The mean is at 43° 17'; Dorpat lies at 44° 23'.*

Otto Struve, son of F G W Struve after whom the Geodetic Arc was named, was keen to carry forward the ideas of his father. In 1868 he wrote in depth on the reconnaissance that he had supervised from the southern section of the Struve Arc down to Crete. This he took via Turkey rather than directly through the Greek Islands. Even as he wrote that paper he indicated that he was preparing the equipment ready to start the field work the following month.

This was to have been with the co-operation of Turkey but somehow or other almost at that precise moment conflict arose between the two nations and it would appear that the field work never took place. Although it was not until 1877-78 that the Russo-Turkish War took place something, as yet undetermined, but of major importance, occurred to thwart Otto Struve.

It was around the same time that David Gill was taking over as Her Majesty's Astronomer at the Cape (of Good Hope). Now he had corresponded for some while with Otto Struve and they both had the same dream of someday connecting the two Capes (North Cape in Norway with Cape Province) with a triangulation scheme. While

Otto Struve was striving to extend his father's work to Crete so David Gill was planning a Cape to Cairo triangulation. Such schemes would have left but the crossing of the Mediterranean Sea as a gap in the Cape to Cape dream.

Gill started work in South Africa on a geodetic arc in 1879. Executed piecemeal as money, resources and staff became available, it was not completed until 1954. The same year a crossing of the Mediterranean Sea from North Africa to Crete using Hiran/Shoran was executed by the American Air Force. But what about the stretch from Crete to the Struve Arc?

#### THE ARC OF THE 30<sup>th</sup> MERIDIAN

As already mentioned, this was started in 1879 by David Gill and by 1892 all of its length in South Africa was complete together with two of the four baselines. 1897-1901 saw much of Southern Rhodesia (Zimbabwe) completed by Simms except for a small piece around 21°-22° south which was filled in later. 1903-06 saw Rubin complete most of Northern Rhodesia (Zambia) and in 1908-09 Jack and McCaw did a section in southern Uganda. Thus between 1879 and 1909 the great majority of the triangulation from S Africa to the Equator was completed. The gap was from 10° S northwards to 1° S. This was partly completed by Hotine in 1931-33 and the rest by the Tanganyika (Tanzania) Survey Department in 1936-38.

Looking now from the Mediterranean Sea southwards Egypt was covered between 1907 and 1930 and much of The Sudan at varying periods between 1901 and 1951. This left one last section of around 600 miles in southern Sudan and Northern Uganda which was the most difficult of all because of the terrain in the Sudd. This was finally filled in with the assistance of the US AMS during 1952-54. So the whole arc had taken 75 years to complete.

#### CROSSING THE MEDITERRANEAN SEA

By the time of completion of the 30<sup>th</sup> Arc survey techniques had sufficiently developed for it to be no longer necessary to carry the connecting survey round the Eastern end of the Mediterranean Sea through Palestine, Syria and Turkey before striking out northwards towards the Struve Arc. Using Shoran/Hiran, a form of radar technique to accurately measure very long distances, a connection was feasible from the North African coast to Crete. To do this the Arc in Egypt was extended westwards to just inside Libya so as to set up three survey stations that would make a suitably shaped figure with three points on Crete and Rhodes.

Thus was completed the whole of the section from near Port Elizabeth in S Africa to Crete and on northwards to the North of Norway although many of the records for the connection south from Poland remain to be found.

# THE ARC OF THE 30th MERIDIAN

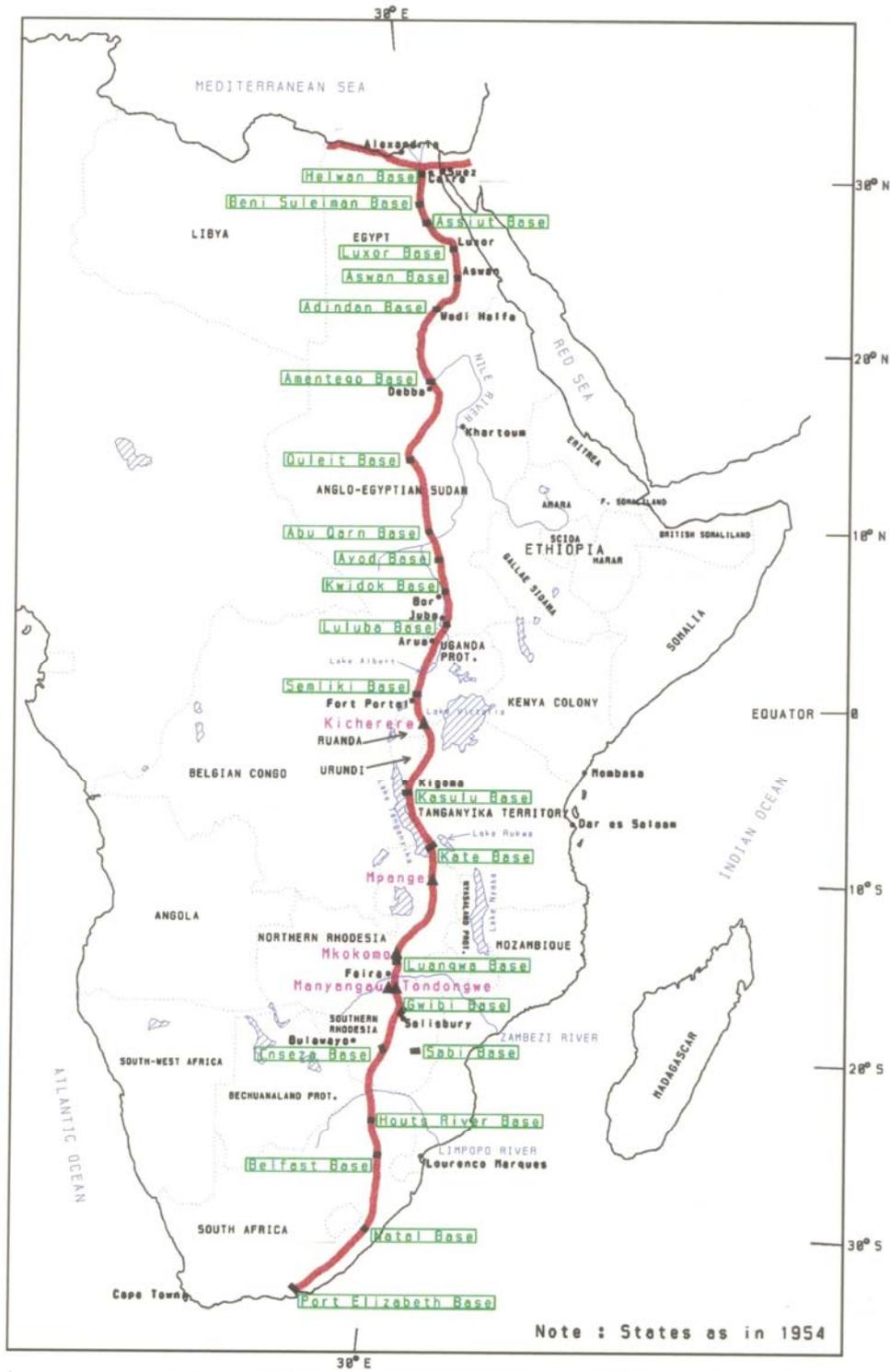


Figure 1.

(Courtesy of T Zakiewicz)

## THE CONNECTION FROM POLAND TO CRETE

Between the two Great Wars there were moves in the AIG (International Association for Geodesy) to observe an “Arc de Méridien de l’Océan Glacial Arctique à la Méditerranée “. Later this title was extended to read “.... Prolongé jusqu’en Afrique ....”

Maps of this new triangulation indicate that there were up to 14 survey stations said to be “coincident with Struve stations”. The difficulty with this connection is that when it was observed the territory was part of Poland, today it is in Belarus. Neither country seems to be sure which holds the records (if any still exist) of the survey observations and results or in fact whether they might even be held somewhere in Russia.

Various of the possible coincident stations have been investigated and it was reported in 2004 that the Polish chain coincided in three areas with that of Struve. However not all of the stations described were truly “coincident” but other stations of the same name nearby. Some 7 stations can be either proved or look promising if coincidence can be verified.

The map in Figure 2 below shows the triangulation from Poland southwards. The location of the coincident points between this triangulation and the Struve Geodetic Arc is further north in Poland just south of its border with Lithuania. (Figure 3). It is hoped that these stations will be further investigated in the near future so that there is a firm foundation on which to pursue the rest of this triangulation down to Crete

Any readers with information on the areas of coincidence or of this arc in general please make contact. (See addresses below under Enquiries). Those parts executed in Africa mostly by the British over many years used to be all kept in one archive but they have recently been dispersed to seven different locations to make it infinitely more difficult for researchers.

## MARKING THE ARC OF THE 30<sup>th</sup> MERIDIAN

In June 2004 a plaque was unveiled on the southernmost station of the 30<sup>th</sup> Arc at Buffelsfontein near Port Elizabeth. Then in April 2005 another plaque was unveiled near Cairo at a station near to the northern end of the 30<sup>th</sup> Arc. Thus recognising the importance of the Arc to the surveying profession.

It is hoped that in the coming years each of the countries 11 countries through which the 30<sup>th</sup> Arc passes (except those that only have one or two- i.e. Botswana and Mozambique) will select a representative number of the surviving stations and do the necessary for them to form part of a submission to UNESCO as an extension to the Struve Heritage monument.

The countries involved contain the following numbers of 30<sup>th</sup> Arc stations:

Egypt	98
Sudan	198
Uganda	29
Congo	10
Burundi	4
Tanzania	55
Zambia	33
Mozambique	2
Zimbabwe	62
Botswana	1
South Africa	<u>116</u>
Total	608

# TRIANGULATION FROM POLAND TO CRETE 1929

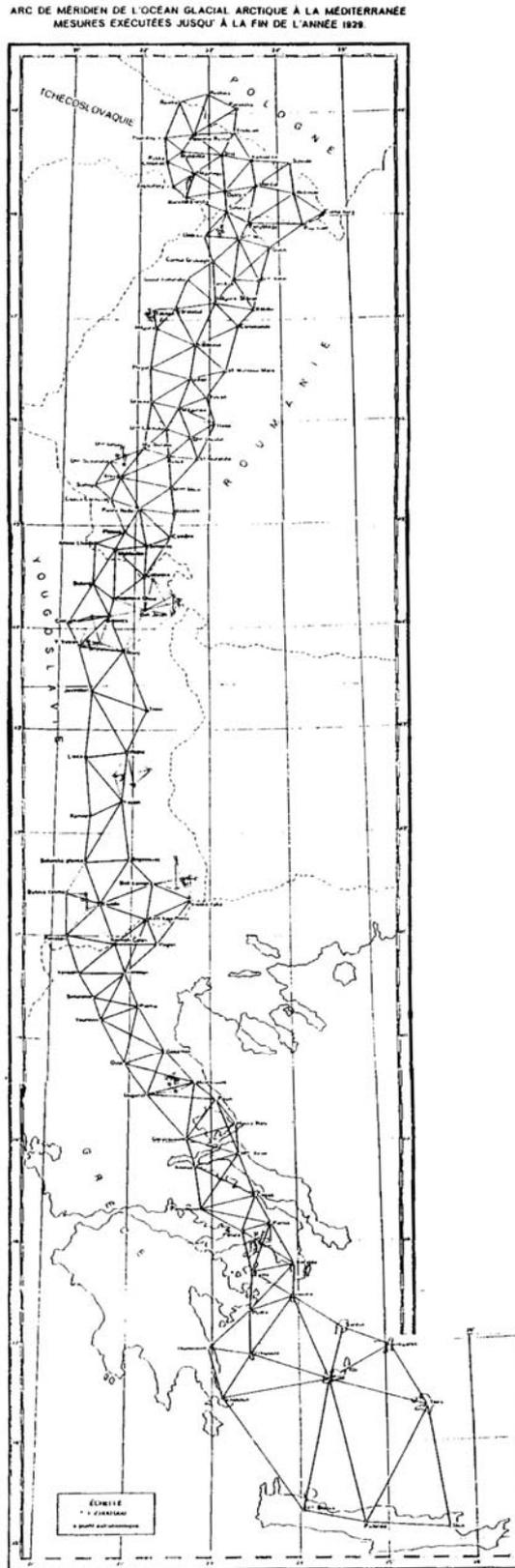


Figure 2.

TRIANGULATION IN POLAND AS AT 1936

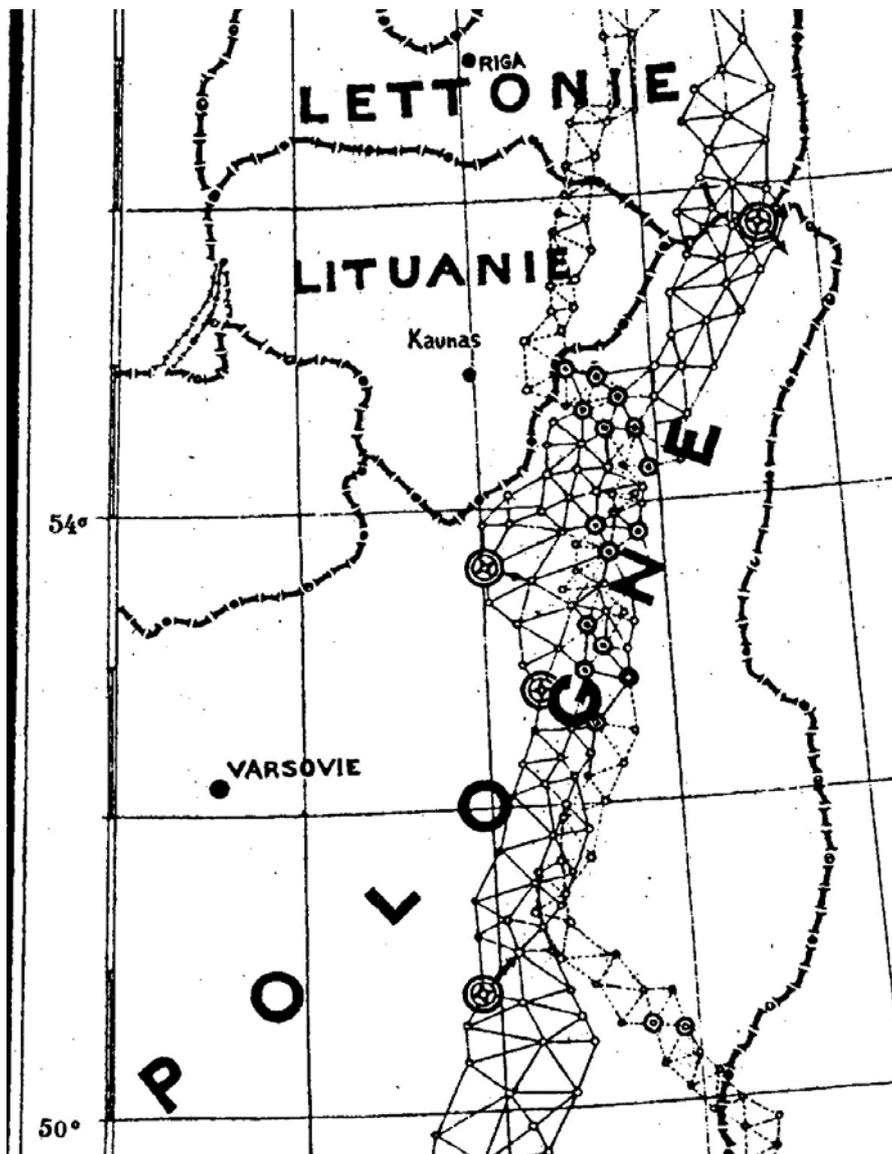


Figure 3.

- Dashed lines = Struve arc
- Solid lines = National triangulation
- Double circles = Points coincident with those of Struve
- Large circles = astronomical points

STATISTICS FOR THE CONNECTING ARC AND ARC OF 30th MERIDIAN

	Connecting Arc	Arc of 30 <sup>th</sup> Meridian
Northern terminal	Meskonys	F-1. North East of Cairo
Latitude	54° 55' 51" N	30° 01' 43" N
Longitude	25° 19' 00" E	31° 16' 34" E
Southern terminal	F-1. North East of Cairo	Buffelsfontein
Latitude	30° 01' 43" N	33° 59' 32" S
Longitude	31° 16' 34" E	25° 30' 43" E
Overall linear length	Approx. 2 769 km	Approx. 7 120 km
Overall angular length	24° 54' 08"	64° 01' 15"
Countries involved (modern-day boundaries)	10 = Lithuania, Belarus, Poland, Ukraine, Rumania, Yugoslavia, FYROM, Greece, Crete, Egypt.	11 = Egypt, Sudan, Uganda, Tanzania, Congo, Burundi, Zambia, Mozambique, Zimbabwe, Botswana, South Africa
Number of main stations	Approx. 220	608
Number of baselines	Approx. 17	23
Number of astro. stations	?	42
Started	1924	1879
Completed	1954	1954
<b>Fuglenaes to Buffelsfontein</b>		<b>104° 39' 43"</b> <b>= approx. 11635 km</b>

REQUEST

Any readers with knowledge of any of the following are asked to contact the author by e-mail at:- [jim@smith1780.freerve.co.uk](mailto:jim@smith1780.freerve.co.uk)

- (a) the points said to be "coincident"
- (b) the observations and results for any part of the connecting triangulation
- (c) knowledge of any publications in which papers/reports appear on any part
- (d) anything to do with the scheme