Grids & Datums

REPUBLIC OF UGANDA

by Clifford J. Mugnier, C.P., C.M.S.

"Uganda experienced two great waves of migration. The first brought the Bantu-speaking peoples from further west in Africa, and the second, the Nilotic people from Sudan and Ethiopia. These broad families are still geographically split today, the Bantu in the center and south of the country and the Nilotic peoples in the north. Until the 19th century, landlocked Uganda saw few outsiders compared with its neighbors. Despite fertile lands and surplus harvests, trading links with the great Indian Ocean ports were limited. During the reign of the Bugandan *kabaka* (king) Mwanga in the mid-19th century, contacts were finally made with Arab traders and early European explorers" (*Lonely Planet, 2012*). "The colonial boundaries created by Britain to delimit Uganda grouped together a wide range of ethnic groups with different political systems and cultures. These differences prevented the establishment of a working political community after independence was achieved in 1962. The dictatorial regime of Idi Amin (1971-79) was responsible for the deaths of some 300,000 opponents; guerrilla war and human rights abuses under Milton Obote (1980-85) claimed at least another 100,000 lives. The rule of Yoweri Museveni since 1986 has brought relative stability

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and economic growth to Uganda. During the 1990s, the government promulgated non-party presidential and legislative elections" (*World Factbook, 2012*).

Bordered by the Democratic Republic of the Congo (Kinshasa) (765 km) (*PE&RS*, June 2005), Kenya (933 km) (*PE&RS*, June 2003), Rwanda (169 km), South Sudan (435 km), and Tanzania (396 km) (*PE&RS*, February 2008); slightly smaller than Oregon, the terrain is comprised mostly of plateau with a rim of mountains. The lowest point is Lake Albert (621 m), and the highest point is Margherita Peak on Mount Stanley (5,110 m).

Prior to becoming a protectorate of the British Empire, the concept of land ownership was unknown in Uganda. The British established the Mailo System in which land parcels were assigned to various levels of local royalty with the British Crown taking ownership of areas undesired by Ugandans. The sheer size of the number of parcels necessitated the training and employment of local Ugandans as surveyors, with mixed results with regard to the quality of the surveys and descriptions of calls. Consequently, a system of geodetic control was recognized as a requirement for a successful cadaster. The first datum established in Uganda Protectorate by the British was at origin point Busowa M.T.S. (M.T.S. = Main Triangulation Survey – Ed.) in 1907

where: Φ_o = 00° 46' 01.492" N, Λ_o = 32° 12' 59.324" East of Greenwich, and the azimuth to Katwe Kangili M.T.S. was α_o = 320° 01' 56.4" North by East (clockwise – Ed.). The ellipsoid of reference was the Clarke 1858 where: a = 6,378,235.6 m, and $1/_f$ = 294.2606768.

In 1929, a new datum was introduced with a new origin at Igurua (Arc of Meridian) (*The "Arc of Meridian" refers to points included in the famous survey of the 30° East meridian which was from South Africa to Finland, Russia, and Norway – Ed.*) where: Φ_o = 00° 57' 18.173" S, Λ_o = 30° 21' 52.756" East of Greenwich, and the azimuth from Kicherere (Arc of Meridian) to Karamrani (Arc of Meridian) was α_o = 340° 59' 52.11" North by East. The ellipsoid of reference was the Clarke 1858 again. "Rectangular spheroidal co-ordinates are plotted in 3 zones of Cassini Soldner co-ordinates based on the following origins: – Busowa M.T.S. (1907 determination), latitude 0° 46' 01.492" North, longitude 32° 12' 59.324" East. Busoga Origin, latitude 0° 30' 00" North, longitude 33° 30' 00" East. Toro Origin, latitude 0° 30' 00" North, longitude 30° 30' 00" East. Apparently the above particulars refer to work done before the years 1939-40, when it was decided to replace the Cassini Soldner co-ordinates by the Transverse Mercator system. "The report does not include among the other geodetic data any particulars of the origin, etc., of this system, and the only reference to it is a more or less casual remark to the effect that all the special Tables required for working on it were being computed by Messrs The Scientific Computing Service, Ltd., that most of the work had been done, although all the results had not yet been received, and that about £600 had been expended during the last year with this firm. These Tables have now been completed, and, through the courtesy of Dr. J.L. Comrie, the Managing Director of the firm, the present writer has been able to see a copy. From the introduction it appears that the Tables are based on the following fundamental data: – (1) Central Meridian, 32° 30' East. (2) Origin of co-ordinates. Intersection of this meridian with the equator. (3) False co-ordinates of Origin: Northing = 1,000,000 feet. Easting = 1,350,000 feet. (4) Scale factor for reduction of scale error = 0.9995. (5) Figure of the earth is Clarke's 1880 figure, for which the fundamental geodetic quantities are given in the R.G.S. Table V. Thus the figure of the earth now adopted is different from that introduced in 1929 and it is presumed that the re-computation of the main triangulation already mentioned is based on the Clarke 1880 figure" (*G.T. McCaw, Empire Survey Review, No. 52, pp. 257-*

262). These Transverse Mercator parameters are generally attributed to Hume F. Rainsford, the author of *Survey Adjustments and Least Squares, Constable, 1957* in which he discusses his association with the Directorate of Overseas Surveys (DOS) while in Uganda. Note that the Clarke 1880 ellipsoid is where: a = 6,378,249.145 m, and $1/_f$ = 293.465. "The circuits formed by several triangulation chains have been re-computed a number of times to rectify discrepancies in various circuits. The last re-computation was done in 1960, and the Uganda main triangulation was adjusted to fit the new co-ordinates of the 1960 re-computation of the 30th meridian arc. In Uganda, our "datum" is now known as the "1960 Arc Datum." The 1960 re-computation of the 30th meridian replaced the 1950 re-computation of the same arc which earlier, had been used to control the main triangulation network" (*The Uganda Triangulation Network: – Estab-lishment and Current Status, Y. Okia and J. Kitaka, Lands and Surveys, Entebbe, Uganda*). Further discussions of triangulation details of the region by Rainsford are in the "Grids and Datums" column on Kenya (*PE&RS*, June 2003). The Cape (Arc) Datum 1960 origin is at Buffels-fontein where: Φ_o = 33° 59' 32.000" S and Λ_o = 25° 30' 44.622" E. The mean value to transform from Arc 1960 Datum to WGS84 in the general vicinity of Uganda (Tanzania & Kenya) is: ΔX = – 160 m, ΔY = – 8 m, ΔZ = – 300 m.

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