& GRIDS & DATUMS

BURKINA FASO

BY Clifford J. Mugnier, CP, CMS, FASPRS

The Grids & Datums column has completed an exploration of every country on the Earth. For those who did not get to enjoy this world tour the first time, *PE&RS* is reprinting prior articles from the column. This month's article on Burkina Faso was originally printed in 2005 but contains updates to their coordinate system since then.

During the early part of the 15th century, the Mossi horsemen of Ghana invaded the area and established a long-lived empire. The Mossi maintained a cavalry that successfully defended its West African territory from hostile Muslim neighbors, and as a result the former Upper Volta is not predominately Muslim. The French came to the area in the late 19th century, established a protectorate (1895-1897), and later partitioned former areas of the empire to Mali, Niger and Côte d'Ivoire. Local natives of Upper Volta were "blackbirded" to work on the French plantations of Côte d'Ivoire in the south. For approximately 60 years, the French favored the Côte d'Ivoire at the expense of Upper Volta. Independence from France came in 1960, and a military coup in 1966 was the first of two decades of coups that culminated in Captain Thomas Sankara taking control and changing the name of the country to Burkina Faso which means "country of the incorruptibles" (Lonely Planet, www.lonelyplanet.com).

Landlocked Burkina Faso is bordered by Benin (306 km), Ghana (548 km), Côte d'Ivoire (584 km), Mali (1,000 km), Niger (628), and Togo (126 km). Slightly larger than Colorado, the lowest point is the Mouhoun (Black Volta) River (200 m), and the highest point is Tena Kourou (749 m). The terrain is mostly flat to dissected, undulating plains with hills in the west and southeast (*CIA Factbook*). The major cities are the capital Ouagadougou (Ouaga), and Bobo-Dioulasso.

The French *Institut Géographique National* (IGN) had the initial mapping and geodetic responsibility, and shared that with the *Annexe de l'Institut Géographique National á Dakar* when the federation of the eight territories constituting French West Africa came into being in 1904. At the time, the IGN Annex, Dakar was known as the *Service Géographique de l'Afrique Occidentale Française* – SGAOF. The IGN later established a network of 200 "Astro" stations (astronomic positions) after 1950 that initially served as the basic control of French West Africa at the scale of 1:100,000 for Burkina Faso. The reference ellipsoid was the Clarke 1880 (IGN) where: a = 6,378,249.2 m, b = 6,356,515.0 m, and computed $^1/_f$ = 293.4660208, the projection and grid is the Universal Transverse Mercator (UTM). These compilations were also used to make maps at smaller scales. Earlier mapping of portions of Burkina Faso were compiled by SGAOF from 1923 at a scale of 1:200,000, entitled C*arte de l'Afrique de l'Ouest au 200.000e*. Pre-1952 sheets were compiled from ground surveys or trimetrogon photography; remaining sheets from aerial photography and astronomic control. Final sheets were checked and contoured in the field. Relief

Photogrammetric Engineering & Remote Sensing
Vol. 88, No. 9, September 2022, pp. 555-556.
0099-1112/22/555-556

doi: 10.14358/PERS.88.9.556

was indicated by contours at 40- or 50-meter intervals with some supplementary relief portrayed by escarpment, cliff, rock outcrop, sand, and sand dune symbols. Post-1952 sheets were cast on the UTM Grid, Zones 30 and 31 (*U.S. Army TM-5-248, Foreign Maps*). In 1950, the SGAOF performed the classical triangulation of the capital city, Ouagadougou.

In 1958, the French IGN and the SGAOF established 54 stations throughout the country by classical triangulation. In 1960, IGN and the U.S. Army Map Service established 46 stations along the 12th parallel. This triangulation throughout Africa was along the 12th parallel and it started at the origin of the Blue Nile Datum of 1958 in Egypt, at station Adindan where: Φ_0 = 22º 10′ 07.1098″ N and Λ_0 = 31º 29′ 21.6079″ East of Greenwich, deflection of the vertical: ξ = +2.38″, η = –2.51″. As I stated in my column on Ethiopia (*PE&RS, March 2003*), "Adindan" is the name of the origin point and it is **not** the name of the datum; an almost universal mistake found in reference works including the DMA/NIMA/NGA *TR 8350.2*.

In 1979, a Doppler satellite survey was undertaken throughout Africa and included the observation of 16 stations in Burkina Faso. The survey was defined on the WGS72 Datum and final results were computed on the Clarke 1880 ellipsoid for collocated points of the 1958 network of stations in Ouagadougou, apparently on the Blue Nile Datum of 1958. In 1997, 55 points were observed with GPS receivers by the *Institut Géographique du Burkina* (IGB) in cooperation with the government of Switzerland. Since 1998, this first-order network of GPS observations has been densified with 217 additional points in the southwestern part of Burkina Faso. Thanks go to Alain Bagre in his report to the FIG for the details of the geodetic history of his country.

The NGA lists transformation parameters for the Blue Nile Datum of 1958 (Adindan) to WGS84 Datum based on a *single point* as: Δa = –112.145 m, Δf x 10^4 = –0.54750714, ΔX = –118 m ±25 m, ΔY = –14 m ±25 m, and ΔZ = +218 m ±25 m.

Burkina Faso Update

"Three weeks (GPS weeks 1653 to 1655, September 11 to October 1, 2011) of Burkina Faso CORS GPS and Glonass data have been processed together with 52 surrounding IGS stations by means of the Bernese GPS Software (version 5.0). The purpose is the determination of ITRF2008 coordinates for the nine Burkina Faso CORS. The average accuracy within ITRF2008 at observation epoch for the whole network is estimated to be 5 mm in North, 6.3 mm in East, and about 12 mm in Up component. The Burkina Faso CORS network has a slightly better accuracy of approximately 5-6 mm in both horizontal components and around 11 mm in up component. The internal accuracy of the Burkina Faso CORS network is 2-3 mm in horizontal components and around 5 mm in up component."

https://www.academia.edu/4874865/ESTABLISHING_A_LAND_POLICY_REFORM_AND_GPS_TECHNOLOGY_IMPLEMENTATION_IN_BURKINA_FASO

In 2014, Aero Ashai Corporation completed a photogrammetric mapping project in the northern area of Burkina Faso (Digital Topographic Mapping Project in Burkina Faso).

https://openjicareport.jica.go.jp