GRIDS & DATUMS

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THE REPUBLIC OF
GABON

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 was originally printed in 1998.

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This month's topic features the Republic of Gabon, the West African country that straddles the equator. The Portuguese settled on the Island of Sao Tomé and discovered the estuary of the Como in 1473. The country is named after the Portuguese word "gabão," a coat with sleeve and hood bearing a resemblance to the shape of that estuary. While the French were establishing trading posts in the 18th century, the trade in black slaves began to flourish in Lambaréné and Cape Lopez. At the beginning of the 19th century, the French chased slave traders away and gained the trust of local chiefs. The capital, Libreville, was created in 1849, and Gabon became a French colony in 1883. From 1910 to 1958, it was part of French Equatorial Africa or "Afrique Equatoriale Francais" (l'AEF Gabon became independent in 1960.

In March 1886, Le Pord of the French Navy used a sextant and two chronometers to determine the position of Libreville as: $\Phi_o = 0°\ 23'\ 15''$ North, $\Lambda_o = +\ 7°\ 06'\ 30''$ East of Paris. In September of 1890, Serres of the French Navy determined the differences in longitude between Libreville and Kotonou with the aid of a telegraph. Audoin of the French Navy established the first classical horizontal datum in Gabon in July of 1911 at Akosso: $\Phi_o = -\ 0°\ 42'\ 45.9''$ South, $\Lambda_o = +\ 8°\ 46'\ 56''$ East of Greenwich. The defining azimuth was determined from Akosso to station signal Alugubuna as: $\alpha_o = 341°\ 47'\ 04.1''$. Akosso 1911 Datum is referenced to the Clarke 1880 ellipsoid where a = 6,378, 249.145 meters, and $1/_f = 293.465$. This datum origin also defined the point of origin for the first Grid used in Gabon, which was based on the Hatt Azimuthal Equidistant Projection.

Hatt was the Hydrographer of the French Navy in the late 19th century, and his projection became the standard "local" projection for individual hydrographic surveys. This projection became synonymous with "Systémé Rectangulaire Usuel" (Usual Rectangular System) for French hydrographic

surveys. Note that until the late 1980's, the Hatt Azimuthal Equidistant projection (and Grid) was also used for the military topographic series of Greece. Of particular note for the Akosso Grid is that one of the points located in the original triangulation was "Phare du Cap Lopez" (Cape Lopez Lighthouse) where X = -10,450.02 meters, and Y = + 10,809.11 meters. Insubsequent triangulations and adjustments, this point would gain particular prominence in Gabon.

The following year, Audoin established the Owendo Datum of 1912 where: $\Phi_o = +\ 0°\ 17'\ 43.9''$ North, $\Lambda_o = +\ 9°\ 29'\ 35.55''$ East of Greenwich and the usual Grid was the Hatt at the Datum origin. In 1914, Lafargue of the French Navy established the Gabon River Datum at Cape Esterias as: $\Phi_o = +\ 0°\ 36'\ 48.58''$ North, $\Lambda_o = +9°\ 19'\ 19.02''$ East of Greenwich. This point would also gain prominence in the history of the classical Datums of Gabon. Lafargue established another

Datum at the North base end (invar baseline) of Pointe Banda in 1921, in the village of Sainte-Marie where: $\Phi_o = -3° 50´ 03.4″$ South, $\Lambda_o = +11° 00´ 46.6″$ East of Greenwich. The defining azimuth was from Banda to Tranchée: $\alpha_o = 158° 59´ 56.0″$. The usual Hatt Grid had the same origin as the Datum. The triangulation stations monumented by Lafargue for this survey were pyramids constructed of cement, and the south side was imprinted "M.H.A.E.F. 1921."

There was no topographic survey of the AEF until after WWII. During the war, the Gabon Belt Transverse Mercator ("Fuseau Gabon") was used such that the ellipsoid of reference was the Clarke 1880. The unit of measurement was the meter, the Central Meridian, $(\lambda_o) = 12°$ West of Greenwich, and the Latitude of Origin, (f_o), by definition was the equator. The Scale Factor at Origin $(m_o) = 0.99931$, the False Northing = 1,500 Km, and the False Easting = 800 Km. The particular math model for this zone was presumably the Gauss-Krüger, identified by the French as "Projection de Gauss."

A geodetic astronomical station in the town of Mporaloko, east of Port Gentil, was set by the "Société des Pétroles d'Afrique Équatoriale" (SPAFE), the Equatorial French Africa Petroleum "Society," (corporation). This position was transferred to the lighthouse at Cape Lopez such that the Cape Lopez Datum of 1951 is synonymous with the Mporaloko Datum of 1951, where: $\Phi_o = -0° 37´ 54.2″$ South, $\Lambda_o = +8° 42´ 13.2″$ East of Greenwich. The Mporaloko 1951 Datum is currently used for most of Gabon that is south of Libreville.

In 1954, Sauzay of the French Navy recovered two of the monuments set by Lafargue in 1921. These two points were Table and Babar. The coordinates adopted for Table were: $\Phi_o = -3° 49´ 13.9″$ South, $\Lambda_o = +10° 00´ 55.0″$ East of Greenwich. Sauzay observed a solar azimuth from Table to Babar such that: $\alpha_o = 348° 09´ 05.5″$. The baseline distance adopted was a mean of the new observations with invar tapes and with those observed by Lafargue in 1921. The Hatt Grid used for this Datum had the same origin with a False Easting and False Northing of 10 kilometers.
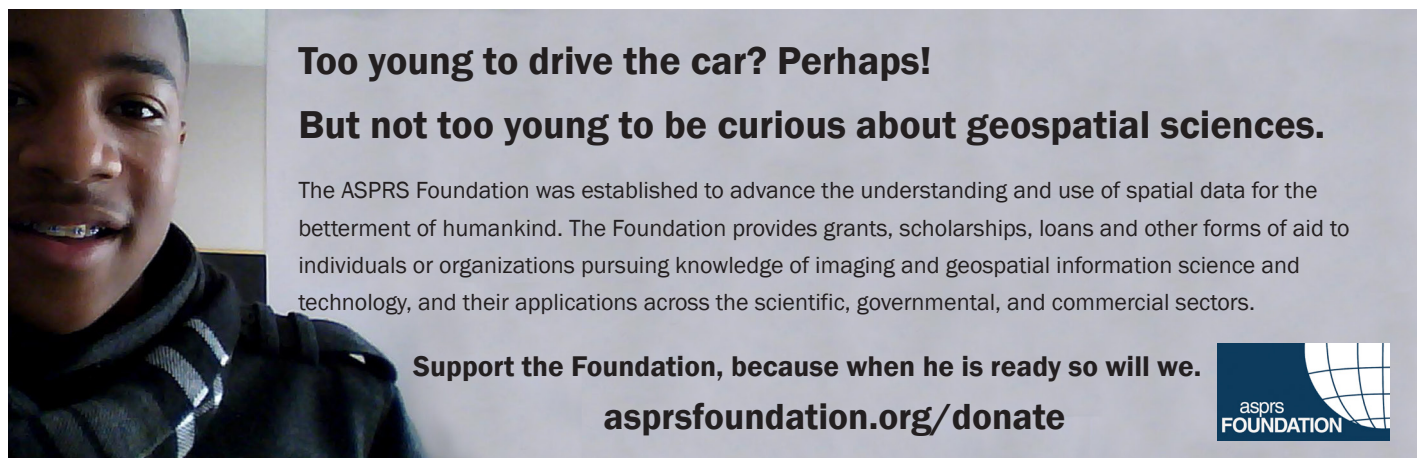
In 1955, Mannevy of the French Navy reoccupied an astro station at Esteiras for the triangulation of the Bay of Corisco, North of Libreville. The Cadastral Service of Libreville measured a three-kilometer baseline in Libreville in concert with the French Hydrographic Mission. The Cape Esteiras Datum of 1955 origin is: $\Phi_o = +0° 36´ 48.58″$ North, $\Lambda_o = +9° 19´ 19.02″$ East of Greenwich. The Department of Public Works of Gabon (Travaux Publics du Gabon) assisted Mannevy by building towers for the triangulation of the Bay of Corisco. The triangulation was performed with WILD T3 theodolites using eight sets of angles. The design of the towers and targets were patterned after those used in Madagascar. The first computations on the Universal Transverse Mercator Grid in Gabon were computed by Mannevy with the Clarke 1880 ellipsoid, Fuseau 32 (zone 32), where Central Meridian $(\lambda_o) = +9°$ East of Greenwich. The Cape Esteiras 1955 Datum is used for Libreville and points north in Gabon.

The latest edition of "TR8350.2" by the National Imagery and Mapping Agency (NIMA) published in July of 1997 lists the three-parameter shift from M'PORALOKO (sic) Datum to WGS 84 Datum as: $\Delta X = -74$ meters, $\Delta Y = -130$ meters, $\Delta Z = +42$ meters. Note that only one point was used to determine the published shift, and the accuracy is stated at ± 25 meters for each component. Such a level of accuracy is acceptable for military artillery purposes or shirt-pocket Global Positioning System receivers when one is working with maps at a scale of 1:25,000 or 1:50,000. But, an uncertainty of ± 25 meters is useless for the precision necessary for seismic geophysical exploration or municipal mapping.