

# Grids & Datums

## ISLAMIC REPUBLIC OF MAURITANIA

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“Mauritania’s mineral wealth has been exploited since Neolithic times. Archeological evidence of a copper mining and refining site near Akjoujt in west-central Mauritania dates from 500 B.C. to 1,000 B.C. Modern exploitation of copper at Akjoujt and the more important ore deposits between Fdèrik and Zouitât began after independence. Berbers moved south to Mauritania beginning in the third century A.D., followed by Arabs in the eighth century, subjugating and assimilating Mauritania’s original inhabitants. From the eighth through the fifteenth century, black kingdoms of the western Sudan, such as Ghana, Mali, and Songhai, brought their political culture from the south. The divisive tendencies of the various groups within Mauritanian society have always worked against the development of Mauritanian unity. Both the Sanhadja Confederation, at its height from the eighth to the tenth century, and the Almoravid Empire, from the eleventh to the twelfth century, were weakened by internecine warfare, and both succumbed to further invasions from the Ghana Empire and the Almohad Empire, respectively. The one external influence that tended to unify the country was Islam. The Islamization of Mauritania was a gradual process that spanned more than 500 years. Beginning slowly through contacts with Berber and Arab merchants engaged in the important caravan trades and rapidly advancing through the Almoravid conquests, Islamization did not take firm hold until the arrival of Yemeni Arabs in the twelfth and thirteenth centuries and was not complete until several centuries later. Gradual Islamization was accompanied by a process of arabization as well, during which the Berber masters of Mauritania lost power and became vassals of their Arab conquerors. From the fifteenth to the nineteenth century, European contact with Mauritania was dominated by the trade for gum arabic. (Note that this was an essential ingredient used by Photogrammetric Technicians for decades when constructing aerial mosaics from contact paper prints – Ed). Rivalries among European powers enabled the Arab-Berber population, the Maures (Moors), to maintain their independence and later to exact annual payments from France, whose sovereignty over the Senegal River and the Mauritanian coast was recognized by the Congress of Vienna in 1815. Although penetration beyond the coast and the Senegal River began in earnest under Louis Faidherbe, governor of Senegal in the mid-1800s, European conquest or ‘pacification’ of the entire country did not begin until 1900. Because extensive European contact began so late in the country’s history, the traditional social structure carried over into modern times with little change” (*Library of Congress Country Studies, 1988*).

Bordered by Algeria (463 km), *PE&RS*, October 2001), Mali (2,237 km), Senegal (813 km), Western Sahara (1,561 km), and the Atlantic Ocean (754 km), Mauritania is slightly larger than three times the size

of New Mexico. The lowest point is Sebket E-n-Dghamcha (–5 m), and the highest point is Kediet Ijil (915 m) (*World Factbook, 2009*).

The first hydrographic survey of the coasts of Mauritania and Senegal was performed by the corvette *La Bayadère* and the escort vessel *Le Lévrier*, commanded by the French Naval Captain Roussin and the Hydrographic Surveyor Givry in 1817. In 1910, Commandant L.V. Lebaill established two signal points at the Cape Blanc Lighthouse. The first published coordinates of the Mauritanian coastline were observed by Naval Ensign Yayer in 1935 with an S.O.M. astralabe for five points: Chauve (cement monument)  $\Phi = 16^{\circ} 46' 33''\text{N}$ ,  $\Lambda = 16^{\circ} 21' 10''\text{W}$ , Nouakchott (post at Officers’ magazine)  $\Phi = 18^{\circ} 05' 53''\text{N}$ ,  $\Lambda = 15^{\circ} 57' 23''\text{W}$ , Angel (cement monument)  $\Phi = 18^{\circ} 38' 29''\text{N}$ ,  $\Lambda = 16^{\circ} 07' 54''\text{W}$ , Mahara (wood target in sand dune)  $\Phi = 19^{\circ} 06' 33''\text{N}$ ,  $\Lambda = 16^{\circ} 17' 06''\text{W}$ , and Timiris (house in the village of Memhar)  $\Phi = 19^{\circ} 21' 21''\text{N}$ ,  $\Lambda = 16^{\circ} 31' 08''\text{W}$ , with all longitudes referenced to Greenwich (*Mission Hydrographique du Sénégal et de la Mauritanie, par M. P. Bonin, Annales Hydrographiques, 3e série, Tome Quinzième, année 1937*). The following year, an extensive survey of Cape Blanc was

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performed and the original signal points of Lebaill’s 1910 work were recovered and included in the survey. The Goëland Datum of 1910 originated at *Signal Goëland* (sea gull) of L.V. Lebaill’s 1910 observation where:  $\Phi_0 = 20^{\circ} 54' 46.72''\text{N}$ ,  $\Lambda_0 = 17^{\circ} 03' 07.09''\text{W}$ , and the ellipsoid of reference was the Gellner 1865 where:  $a = 6,377,397.2$  m, and  $1/f = 299.15$ . Note that this ancient datum was later revised by the French and re-computed on a different ellipsoid in 1961. Apparently because of WWII, the results of this later survey were not published until after the war. (*Annales Hydrographiques, 3e série, Tome Seizième, années 1938-1939, 1946*). From 20 January to 24 February of 1955, a hydrographic survey of the Nouakchott region was performed based on new triangulation that was extended from Yayer’s original work of 1935 (*Mission Hydrographique de la Côte Ouest Afrique, par M. Pierre Mannevy, pp. 43-51*).

In 1961, the French Navy returned to Mauritania and performed 2<sup>nd</sup> Order geodetic surveys of the coast. Interestingly, they recovered some of the old monuments from earlier surveys and re-determined coordinates, both astronomically and geodetically compensated for the local deflection of the vertical as well as re-

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computed these positions on a different ellipsoid. The Goëland Datum of 1910, now re-computed on the Clarke 1880 ellipsoid where:  $a = 6,378,249.145$  m, and  $1/f = 293.465$  changed the astronomic coordinates to:  $\Phi_o = 20^\circ 54' 46.7238''\text{N}$ ,  $\Lambda_o = 17^\circ 03' 08.1820''\text{W}$ , and the geodetic coordinates were now:  $\phi_o = 20^\circ 54' 43.3490''\text{N}$ ,  $\lambda_o = 17^\circ 03' 06.7295''\text{W}$ .

A now-infamous monument and Datum used by oil companies for exploration and production for the coastal area of Mauritania north of Cape Timiris is "Jouik 1961." Apparently unknown to the "oil patch" is that although the UTM coordinates of Jouik were published in 1961, the point was originally observed by Weber of the *Institut Geographique National (IGN) in 1956* where:  $\Phi_o \equiv \phi_o = 20^\circ 30' 29.2626''\text{N}$ ,  $\Lambda_o \equiv \lambda_o = 16^\circ 13' 57.2743''\text{W}$ , the ellipsoid of reference being of course, the Clarke 1880 (*Mission Hydrographique de L'Atlantique Sud (6 Février 1961-18 Février 1963) par M. Antoine Demerliac, Annales Hydrographiques, 4e série, Tome Quatorzième, années 1967-1968, pp. 3-19*). According to version 6.18 of the EPSG database, the transformation parameters **from Jouik 1961 to WGS84** are:  $\Delta X = -80.01$  m,  $\Delta Y = +253.26$  m,  $\Delta Z = +291.19$  m, with the transformation being reported accurate to  $\pm 1$  m and was based on a 5-point solution in 2002 by "Woodside" (*the centimeter precision is dubious - Ed.*).

Other points of great interest in coastal Mauritania published in 1961 include the coordinate reference system originated at Cape Saint Anne and observed by Yayer in 1935 where:  $\Phi_o = 20^\circ 41' 10.2266''\text{N}$ ,  $\Lambda_o = 16^\circ 40' 49.7288''\text{W}$ , and the geodetic coordinates were now:  $\phi_o = 20^\circ 41' 06.6298''\text{N}$ ,  $\lambda_o = 16^\circ 40' 50.2925''\text{W}$ . Also, in 1935 Yayer observed Nouamrhar (Maison de Timiris) where:  $\Phi_o = 19^\circ 21' 21.0036''\text{N}$ ,  $\Lambda_o = 16^\circ 31' 07.9843''\text{W}$ , and the geodetic coordinates were now:  $\phi_o = 19^\circ 21' 20.8220''\text{N}$ ,  $\lambda_o = 16^\circ 31' 06.2062''\text{W}$ .

Also according to version 6.18 of the EPSG database, the transformation parameters **from Nouakchott 1965 to WGS84** are:  $\Delta X = +124.5$  m,  $\Delta Y = -63.5$  m,  $\Delta Z = -281$  m, with the transformation being reported accurate to  $\pm 5$  m and was based on a 7-point solution in 1992 within Nouakchott City. The whopping differences in magnitude and sign between the transformation parameters for Cape Saint Anne and for Nouakchott are to be expected for local datums established by independent astronomical observations. Obviously, there is not a unified triangulation network that covers even the coastal regions of Mauritania much less the remainder of the republic.

On the other hand, according to version 6.18 of the EPSG database, the Mauritania 1999 Datum is based on a unified solution of 35 GPS stations of which 8 were originally observed by *JGN* in 1962. No further data seems to exist at present in the public domain.



The contents of this column reflect the views of the author, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the American Society for Photogrammetry and Remote Sensing and/or the Louisiana State University Center for Geoinformatics (C<sup>4</sup>G).