

Grids & Datums

REPUBLIC OF ALBANIA

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

“The territories of present day Albania have been inhabited as far back as 100,000 years ago. It was at the turn of the third millennium *B.C.* that an Indo-European population settled there. As a result of the mixture, a population incorporating the unique cultural and linguistic characteristics of the whole Balkan Peninsula (pelages) was created. Based on this ancient population, the Illyrian people developed through the second millennium and the first century *B.C.* After its fall in the year 30 *B.C.* Illyria came under the control of Roman Empire. With the division of the Roman Empire (395 *A.D.*), Illyria became a part of the Byzantine Empire.

“The country has suffered continuous invasions over the last 1000 years and by the end of the 14th century Albania was occupied by the Ottoman Empire. The subsequent efforts and insurrections for independence eventually brought about the proclamation of the independence of Albania in 1912. After 1912 till the end of the First World War, the country was attacked by neighboring countries. After eleven years of monarchy the country was occupied by Mussolini forces in 1939, marking the end of the monarchy. In 1943 the armies of Hitler occupied the country.

“The resistance against foreign invasion was known as the Anti-Fascist National Liberation front. The Communist party took power in November 1944, when the foreign armies were expelled. Shortly thereafter, a totalitarian regime was established under the communist leader Enver Hoxha. For about 50 years, the regime applied the policy of self-isolation, leaving the country in great economic poverty when it finally emerged from isolation in 1991. The principle of self-reliance applied by the Communist regime prohibited foreign loans, credits and investment. From 1991 until 1997 The Democratic Party led the country. After the unrests of 1997 due to the failure of pyramidal schemes, the Socialist Party with its coalition was in power until 2005. After the last elections on 3 July 2005 the Democratic Party with its coalition is back in power. Albanian policy intends to integrate the country into the European Community and the Alliance of NATO forces” (*National Tourist Organization of Albania, 2011*).

Slightly smaller than Maryland, Albania is bordered by Greece (282 km) (*PE&RS, December 2002*), Macedonia (151 km), Montenegro (172 km), and Kosovo (112 km). The terrain is mostly mountains and hills with small plains along the coast. The lowest point is the Adriatic Sea (0 m), and the highest point is Maja e Korabit (Golem Korab) (2,764 m) (*World Factbook, 2011*).

The Italian *Istituto Geografico Militare* (IGM) measured a 3,044.2301 m \pm 0.04 m baseline at Lecce (in the heel of Italy’s boot) in 1872 and observed a connection with the Albanian island of Sazan. “The Triangulation Network that was established by the Military Geographic Institute of Vienna (MGIW) during 1860-1873, in the framework of the construction of the geodetic basis was done for mapping of

the Balkans at 1:75000 scale” (*Coordinate Reference Systems Used in Albania to Date, Nikolli, P., & Idrizi, B., FIG Working Week 2011, Morocco, 18-22 May 2011*). The Second Austro-Hungarian Triangulation (II Military Triangulation 1806-1869) used the Vienna University Observatory as the datum origin for regions that included Albania, where: $\Phi_0 = 48^\circ 12' 35.50''$ N, $\Lambda_0 = 34^\circ 02' 36.00''$ East of Ferro, the azimuth to Leopoldsberg, $\alpha_0 = 163^\circ 42' 12.27''$ and the Bessel 1841 ellipsoid of revolution where the semi-major axis (a) = 6,377,397.155 meters and the reciprocal of flattening ($1/f$) = 299.1528. The reference meridian used was Ferro in the Canary Islands, where: $17^\circ 39' 46.02''$ West of Greenwich. The K.u.K. Military Geographic Institute of Vienna observed a 1st Order triangulation net in the Adriatic region that included an Albanian baseline measured just southeast of Lake Scutari at Shkodër in the early 1900s. “(It is only 0.726 m shorter than the Austrian base line measured in 1869.)” (*Mapping of the Countries in Danubian and Adriatic Basins, Glusic, Andrew M., AMS TR No. 25, June 1959, 406 pages.*)

While the Austro-Hungarian lands were mapped with a polyhedral projection, the Albanian Republic was mapped based on an ellipsoidal Bonne projection (*Cohen, Ruth, Geodetic Memo No. 485, Development of Rinner’s Formulas in the Bonne projection and the inverse, Army Map Service, 28 October 1949*), where the projection origin is collocated at the Albanian Datum origin where: $\Phi_0 = 41^\circ 20' 12.809''$ N, $\Lambda_0 = 19^\circ 46' 45.285''$ East of Greenwich and thanks to John W. Hager, the azimuth to East Base measured from North, $\alpha_0 = 294^\circ 38' 02.57''$. This datum origin and projection origin is commonly referred to as being on the Tiranë-Durrës Highway in the Laprakë neighborhood of Tiranë. Upon perusal of *Google Earth*TM imagery, it appears that this point is likely centered in the median of a traffic circle/roundabout on that highway. Although some date the Bonne projection origin in 1918 (*op. cit. Nikolli & Idrizi, 2011*), others date the datum origin in 1932 (*Marcussi, A., Lineamenti geoidici della penisola balcanica, Bollettino Geodetica, vol. XXIV, No. 4*). “In 1946, the Yugoslav first order net was tied with the first order net of Albania. Common stations are: 328 Gruda-Griži, 331 Jubani, 332 Taraboš and 245 Cukali” (*op. cit., Glusic, 1959*).

“ In the 1955, the specialists of Military Topographic Group of Albania carried out the reconstruction and the densification of the IGM Net in order to grant the request for mapping at 1: 25 000 scale. At the same time, the first- order network was transformed from the IGM System (1934) into the 1942 coordinate system, which was based on the Krassovsky ellipsoid, Gauss-Krüger projection with central meridian $\lambda_0 = 21^\circ$ ” (*op. cit., Nikolli & Idrizi, 2011*). The System 42 Datum of the former Union of Soviet Socialist Republics origin is at Pulkovo Observatory where: $\Phi_0 = 59^\circ 46' 18.55''$ North, $\Lambda_0 = 30^\circ 19' 42.09''$ East of Greenwich, the defining azimuth at the point of origin

continued on page 6

to Signal A is: $\alpha_o = 317^\circ 02' 50.62''$ and the ellipsoid of reference is the Krassovsky 1940 where $a = 6,378, 245$ meters, and $1/f = 298.3$. The Russia Belts are a Grid System identical to UTM except that the scale factor at origin is $m_o = 1.0$, and for Albania the System 42 Datum used a central meridian as stated above: $\lambda_o = 21^\circ$.

"In 1960, the Albanian government declared its territorial waters to "embrace a sea area ten nautical miles in breadth in the direction of the open sea, reckoning from the basic shoreline, which connects the following points on the coast: the mouth of River Bojana – Cape Rodini – Cape Pali – Cape Durres – Cape Lagi – Cape Semani – Sazan Island – Cape Linguetta (*kepi Gjuhëzës*) – in the Corpe (Corfu) Channel territorial waters go the middle of the Channel' (*medium filium acquae – Ed.*) The enumeration of these points in the Adriatic Pilot constituted a new Territorial Sea based on the principle of Straight Baselines." (*International Boundary Study, LIMITS IN THE SEAS, No. 7, Albanian Straight Baselines, Office of the Geographer, U.S. Department of State, February 16, 1970.*)

The New Albanian Net, which was constituted from Triangulation and Leveling, was designed, rebuilt, measured and calculated from the Military Topographic Institute of Albania (MTI) during 1970-1985. The readjustment is termed the ALB86 System. The Russia Belts TM continued to be used for this readjustment. (*op. cit., Nikolli & Idrizi, 2011*). In October 1994 the U.S. Department of Defense occupied 35 existing Albanian triangulation stations and established WGS84 Datum positions in cooperation with MTI personnel. The coordinate system adopted by the Military Topographic Institute of Albania after 1994 is

the UTM, Zone 34. This coordinate reference system has transformation parameters for Albania as published by *TR8350.2* where **from** ALB86 **to** WGS84: $\Delta X = +24 \text{ m} \pm 3 \text{ m}$, $\Delta Y = -130 \text{ m} \pm 3 \text{ m}$, $\Delta Z = -92 \text{ m} \pm 3 \text{ m}$.

The National Report of Albania for 2009 listed new 7-parameter Bursa-Wolf transformation results computed by the Department of Geodesy of the Polytechnic University of Tirana **from** ITRF96 (epoch 1998.1) **to** ALB86 as: $\Delta X = +35.758 \text{ m}$, $\Delta Y = +11.676 \text{ m}$, $\Delta Z = +41.135 \text{ m}$, $R_x = +2.2186''$, $R_y = +2.4726''$, $R_z = -3.1233''$, $\delta s = +8.3855 \text{ ppm}$ based on 18 collocated points. (*Gjata, G., et al, EUREF2009 Symposium, Florence, Italy, May 2009.*) The following year, the Instituto Geografico Militare of Italy computed a similar transformation based on 90 collocated points in Albania **from** ETRF2000 **to** ALB86 as: $\Delta X = +44.183 \text{ m}$, $\Delta Y = +0.58 \text{ m}$, $\Delta Z = +38.489 \text{ m}$, $R_x = +2.3867''$, $R_y = +2.7072''$, $R_z = -3.5196''$, $\delta s = +8.2703 \text{ ppm}$. (*Isufi, E., et al, Overview on Albanian Reference Systems, actual situation and the future challenge, BALGEOS, Vienna, January 2010.*) Significant progress has been achieved for a new Albanian Geoid, and the Albanian Association of Geodesy appears to be flourishing.



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