# Grids & Datums

## Republic of Namibia

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According to Lonely Planet, "Southern Africa's earliest inhabitants were the San, a nomadic people organized in extended family groups who could adapt to even the severest terrain. San communities later came under pressure from Khoi-Khoi groups. The Khoi-Khoi were a tribal people who raised livestock rather than hunted, and who were among the first pottery makers in the archaeological record books. They came from the south, gradually displacing the San, and remained in control of Namibia until around 1500 AD. Descendants of the Khoi-Khoi and San people still live in the country, but few have retained their original lifestyles. Between 2,300 and 2,400 years ago, the first Bantus appeared on the plateaus of south-central Namibia. Their arrival marked the first tribal structures in southern African societies. Other tribes either retreated to the desert or the swamps of the Okavango Delta or were enslaved into Bantu society. Because Namibia has one of the world's most barren and inhospitable coastlines, it was largely ignored by European explorers. The first European visitors were Portuguese mariners seeking a way to the Indies in the late 15th century, but they confined their activities in Namibia to erecting stone crosses at certain points along the coast as navigational guides. It wasn't until the last-minute scramble for colonies towards the end of the 19th century that Namibia was annexed by Germany, except for the enclave of Walvis Bay, which was taken in 1878 by the British for the Cape Colony. In 1904, the Herero people, who were Bantu-speaking cattle herders, launched a rebellion, but it was brutally put down. Meanwhile, in the south, diamonds had been discovered east of Lüderitz by a South African laborer. In the blink of an eye, the German authorities branded the entire area between Lüderitz and the Orange River a sperrgebiet, or forbidden area. German rule came to an end during WWI when German forces surrendered to a South African expeditionary army fighting for the Allies." Namibia gained her independence on 21 March 1990 from the Union of South Africa.

**The moral of this particular column is the "first principle of engineering;" KISS – "Keep It Simple, Stupid."**

Namibia is bordered on the West by the South Atlantic Ocean (1,572 km), and by the following countries in clockwise order from the north: Angola (1,376 km) (*PE&RS*, March 2001), Zambia (233 km) (*PE&RS*, October 2004), the Caprivi Strip (Zipfel) extends to Zimbabwe (Tripoint) (*PE&RS*, November 2003), Botswana (1,360 km) (*PE&RS*, May 2004), and South Africa (855 km). The Angola-Zambia-Namibian "Triune" point was reported on 21 October 1964 as Beacon No. 9 (corresponding to Beacon No. 32 of the Kwando series), located at: $\phi$=17°28'29.28"S, $\lambda$=23°25'47.604"E. The country is slightly more than half the size of Alaska; the terrain is mostly high plateau with the Namib Desert along the coast and the Kalahari Desert in the east. The lowest point is the South Atlantic Ocean (0 m), and the highest point is Konigstein (2,606 m).

The first geodetic surveys and small scale topographic mapping was accomplished between 1885 and 1915 by three German agencies: the *Königliche Preußische Landesaufnahme* (Royal Prussian Survey Office), it civilian successor, *Reichsamt für Landesaufnahme* (Empire Land Survey Office), and the Generalstab des Heeres (General Staff of the Army). These agencies produced maps at scales of 1:100,000, 1:200,000, and 1:1,000,000; they varied greatly in the amount of detail, and were inaccurate. However, since the original classical trigonometric surveys were observed by the Germans, the ellipsoid of reference was, and still is, the Bessel 1841 where: $a$=6,377,483.865 m, and $1/f$=299.1528128. Note that the strange value for a is because of the conversion between the International (SI) meter and the "Namibian Legal Meter." (Thanks to David Johanson of the U. S. Naval Oceanographic Office for that tidbit.) The classical geodetic system of Namibia (onshore and offshore) is the Schwarzeck Datum of 1903 where the origin is: $\Phi_o$=22°45'35.820"S, $\Lambda_o$=18°40'34.549"E, fixed during the German South West Africa – British Bechuanaland Boundary Survey of 1898-1903. (Thanks to the EPSG Database for that gem of information.) According to Professor Charles L. Merry and Mr. J. Rens, "the initial point Schwarzek is near Gobabis. … The geoidal height and deflections of the vertical at this initial point are assumed to be zero."

The national grid system of Namibia, the "Southwest Africa Transverse Mercator Belts" includes Central Meridians ($\lambda_o$)=13°E, 15°E, 17°E, 19°E, 21°E, 23°E, and 25°E. The Scale Factor at Origin is equal to unity (1.0), the False Northing Latitude of Origin is 22°S, and there is no reported False Easting or False Northing; a common practice of the late 19th century Europeans. My guess is the grid system has been renamed since the republic has achieved its independence.

Again according to Professor Merry and Mr. Rens in Survey Review, 30, 236 (April 1990) "In 1982 and 1983 the African Doppler Survey (ADOS) was carried out as a project supported by the International Association of Geodesy, in which precise absolute positions were determined in most African countries. … three (sites were located-Ed.) in Namibia. In 1980 the South African Surveys and Mapping

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Directorate commenced a systematic satellite Doppler survey of South Africa and Namibia, using the translocation technique. … Over the past few years a number of estimates of geoidal heights for southern Africa have been made. We will now use the most recent one. However, the geoid is needed in the determination of these same transformation parameters. This apparent impasse can be resolved by iteration. In the case of the Cape Datum one of the ADOS points is close to the initial point where the geoidal height is known to be zero, for the Namibian Datum the initial point is an ADOS point. In each case preliminary translation components can be determined at the initial point and applied to the (Conventional Terrestrial System – Ed.) CTS-based geoid; this transformed geoid can then be used in the process of determining a final set of transformation parameters for the appropriate datum.

"Turning now to Namibia, the results for this datum are summarized. . . . Although the rotations are not as large as those in Zimbabwe and are barely significant, they do serve to model distortions in the geodetic network and hence provide an improved fit between this network and the CTS. Again it must be emphasized that these rotations have no physical interpretation. As in all the countries investigated, except for South Africa, the scale factor plays no major role. Although the seven-parameter set does improve the fit, it is by no means as remarkable an improvement as that experienced in Zimbabwe and it is debatable whether the extra effort is worth it. Consequently, we recommend that (the-Ed.) three-parameter transformation shown: $\Delta X$=+616.6 m ±1.3 m, $\Delta Y$=+103.0 m ±1.3 m, $\Delta Z$=–256.6 m ±1.3 m. … As in Zimbabwe, the Namibian networks suffer from significant distortions but in this case a seven-parameter transformation provides little improvement over a three-parameter transformation."

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