# The Republic of Kiribati

Pronounced "kir-ih-bahss," the islands were originally settled by Austronesians thousands of years ago. Around the 14th century AD, the islands were invaded by Fijians and Tongans. The first recorded European encounter with Kiribati was by the Spanish explorer Quiros in 1606. By 1820, all of the islands had been charted. At that time, the Russian hydrographer A. I. Krusenstern gave the group the name Gilbert Islands. Until 1870, many British and American whaling vessels sought sperm whales in Gilbertese waters. Starting in 1850, trading vessels passed through seeking at first coconut oil and later copra. In the 1860s, slave ships known as "blackbirders" carried off islanders to work in plantations in Peru, Fiji, Tahiti, Hawaii, and Australia. The male population was decimated, and European disease (measles) took a further large toll on the "I'Kiribati" people. The Ellice group (now Tuvalu – *PE&RS*, December 2001) and the Gilbert Islands became a British Protectorate in 1892. In 1975, the Ellice Islands seceded from the colony and became the independent nation of Tuvalu. On 12 July 1979, Kiribati obtained its own independence from the United Kingdom and became a republic within the Commonwealth.

Kiribati consists of a three-island group: the Gilbert Islands, the Line Islands, and the Phoenix Islands. These groups of islands straddle the equator and the International Date Line, about half way between Hawaii and Australia. In 1995, The Republic of Kiribati proclaimed that all of its territory lies in the same time zone as the Gilbert Islands group (GMT + 12). The total land area equals 717 sq km, about four times the size of Washington, D.C. The country is composed of mostly low-lying coral atolls surrounded by extensive reefs. The lowest point is the Pacific Ocean, the highest point is on Banaba Island (81 m). Twenty of the 33 islands are inhabited, and the capital is Tarawa.

According to Russell Fox of the Ordnance Survey, "We revised our Tarawa 1:50,000 map in 1997 and produced new 1:25,000 photomapping of the Line and Phoenix Islands in 1995/96 using Australian Army aerial photography, but we did not do any geodetic survey work in that decade. I believe that a GPS survey, aerial photography and new mapping (on WGS84) project was planned for Tarawa for 1998/99 under Australian aid. The following notes summarise what we know about Kiribati.

Background: The Republic of Kiribati (pronounced "kiribass") comprises the Gilbert, Phoenix and Line island groups in the central Pacific Ocean. Total land area 717 sq km, total sea area 5.2 million sq km, greatest extent 4000 km W-E by 2000 km N-S. The modern republic has its genesis in a British protectorate proclaimed in 1892, which became the Gilbert and Ellice Islands Colony in 1916. Independence was granted to the Gilbert, Phoenix and Line Islands in 1979 as the Republic of Kiribati. The Ellice Islands had previously seceded, in 1975, as the Republic of Tuvalu. The International Date Line passes through Kiribati, but the Government of Kiribati has (legitimately) legislated that the Line and Phoenix Islands will observe the same date as the Gilbert Islands.

Survey history: The Royal Navy carried out hydrographic surveys, based on astro fixes, from the early nineteenth century onward. Little survey and mapping work was done by the British colonial authorities before WW2. Japanese military occupation of the Gilbert Islands in 1941 lead to extensive aerial photography and mapping by the US armed forces, who drove out the enemy in fierce fighting. Post-WW2: Aerial photography: Gilbert Islands RNZAF 1962/63; USN 1964; Fiji Lands, Mines and Survey Department 1968/69. The 1968/69 cover was used subsequently by the Directorate of Overseas Surveys (DOS) for mapping. Line Islands RAF 1950s. Phoenix Islands RNZAF 1962/63. All Kiribati, 1984/85, by the Royal Australian Survey Corps, as part of Operation Anon, one of the Australian Army's Pacific Doppler campaigns.

Survey: DOS control surveys 1967-73, by Tellurometer traversing, covered all the islands in the Gilbert group, with each atoll on its own astro datum and local Transverse Mercator grid. International Spheroid (DOS's default spheroid for the Pacific) was used. Christmas Island was surveyed by the RNZN, British Military Survey and contract staff between 1941 and the 1960s, and by the Kiribati Survey Department in 1979/80. DOS then brought those surveys together, computing on Christmas Island 1967 Astro Datum, International Spheroid, Kiritimati Local [TM] Grid. The first modern survey work in the Phoenix and Line Islands was the precise Doppler campaign of 1984/85. Mapping: DOS produced 1:25,000 (a few sheets were done at 1:12,500 & 1:10,000), photomap series of all the islands between 1972 and 1996. The larger atolls, Tarawa and Kiritimati (Christmas Island), were also mapped at 1:50 000 on single sheets. Generally two editions were produced, one showing the local TM grid, and the other (for military use) UTM grid. Early editions of the Christmas Island sheet showed UTM Grid only. Southern Tarawa was mapped at 1:2500 and 1:1250." All of these classical Datums are referenced to the International 1924 ellipsoid where $a$ = 6,378,388 m, and $1/f = 297$.

Starting with specifics for the Gilbert Islands Group, for the Abaiang Datum of 1962, the Datum origin is at the first-order station Flagstaff of Government Station, also called HMS Cook Astro "H" where $\Phi_o$ = 01° 49' 25.029" N and $\Lambda_o$ = 173° 01' 25.830" East of Greenwich. According to a British Admiralty Report of Survey file, "The Government flagstaff on a coral rock plinth in the centre of the Government Station – Taburao." The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 172º 55' E, the False Easting = 20 km, and the False Northing = zero. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Abaiang Datum of 1962 to WGS 84 Datum, the converted Doppler solution is $\Delta X$ = +254.8 m, $\Delta Y$ = –322.4 m, and $\Delta Z$ = –270.0 m. The Operation ANON 1984-85 solution is $\Delta X$ = +254.3 m, $\Delta Y$ = –323.4 m, and $\Delta Z$ = –275.6 m.

For the Abemama Datum of 1944, the Datum origin is at Signal Station, southwestern tip of Steve Island (Station 'Flag'), where $\Phi_o$ = 00° 27' 36" N and $\Lambda_o$ = 173° 49' 11" East

***Generally two editions were produced, one showing the local TM grid, and the other (for military use) UTM grid.***

of Greenwich. For the Abemama Datum of 1959, the Datum origin is at Cook Astro Point where $\Phi_o$ = 00° 24' 19.02" N, $\Lambda_o$ = 173° 55' 36.57" East of Greenwich, and $H_o$ = 2.14 m. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 173° 51' E, the False Easting = 20 km, and the False Northing = 100 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Abemama Datum of 1959 to WGS 84 Datum, the converted Doppler solution is $\Delta X$ = +289.4 m, $\Delta Y$ = +656.2 m, and $\Delta Z$ = +303.4 m. Note that the UTM coordinates of local traverses depend on the position of Observation Spot that was connected by traverse to C where $\varphi_o$ = 00° 24' 29.02" N and $\lambda_o$ = 173° 55' 36.57" E.

For the Arorae Datum of 1965, the Datum origin is at Arorae Astro Observation Spot where $\Phi_o$ = 02° 38' 36.7" S and $\Lambda_o$ = 176° 49' 33.3" East of Greenwich. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 176° 49' E, the False Easting = 10 km, and the False Northing = 500 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Arorae Datum of 1965 to WGS 84 Datum, the converted Doppler solution is $\Delta X$ = +221.4 m, $\Delta Y$ = –34.4 m, and $\Delta Z$ = –21.6 m.

For the Beru Datum of 1970, the Datum origin is at third-order station BRZ 10 where $\Phi_o$ = 01° 19' 29.9632" S, $\Lambda_o$ = 175° 59' 16.9134" East of Greenwich, and $H_o$ = 1.73 m. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 175° 59' E, the False Easting = 10 km, and the False Northing = 300 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Beru Datum of 1970 to WGS 84 Datum, the converted Doppler solution is $\Delta X$ = +179.9 m, $\Delta Y$ = –595.3 m, and $\Delta Z$ = +6.96 m. The Operation ANON 1984-85 solution is $\Delta X$ = +181.3 m, $\Delta Y$ = –585.6 m, and $\Delta Z$ = –7.2 m.

For the Butaritari Datum of 1965, the Datum origin is at third-order station BTZ 26 where $\Phi_o$ = 03° 15' 40.629" N, $\Lambda_o$ = 172° 41' 45.8381" East of Greenwich, and $H_o$ = 1.87 m. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 172° 50' E, the False Easting = 20 km, and the False Northing = zero. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Butaritari Datum of 1965 to WGS 84 Datum, the converted Doppler solution is $\Delta X$ = +253.8 m, $\Delta Y$ = +6.1 m, and $\Delta Z$ = +528.2 m. The Operation ANON 1984-85 solution is: $\Delta X$ = +254.2 m, $\Delta Y$ = +3.2 m, $\Delta Z$ = +544.2 m.

For the Kuria Datum of 1962, the Datum origin is at HMS Cook Astro, Kuria 1962 where $\Phi_o$ = 00° 13' 00.4" N and $\Lambda_o$ = 173° 23' 06.8" East of Greenwich. The local Kuria and Aranaka Grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 173° 30' E, the False Easting = 30 km, and the False Northing = 100 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Kuria Datum of 1962 to WGS 84 Datum, the converted Doppler solution is based on a fourth parameter where a Z-axis rotation is performed first (algebraically added to the longitude), where $R_z$ = 102.84765" and then the standard three-parameter shift is performed where $\Delta X$ = +219.1 m, $\Delta Y$ = –24.9 m, and $\Delta Z$ = +137.0 m. The Operation ANON 1984-85 solution is $R_z$ = 102.804", $\Delta X$

*continued on page 783*

*continued from page 781*

= +218.6 m, ΔY = –24.8 m, and ΔZ = +140.1 m,

For the Little Makin Datum of 1972, the Datum origin is at station Bikati Astro where $\Phi_o$ = 03° 16' 19.90" N and $\Lambda_o$ = 172° 40' 36.21" East of Greenwich. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 172° 50' E, the False Easting = 20 km, and the False Northing = zero. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Little Makin Datum of 1972 to WGS 84 Datum, the converted Doppler solution is ΔX = +243.4 m, ΔY = +221.1 m, and ΔZ = –104.1 m. The Operation ANON 1984-85 solution is ΔX = +239.5 m, ΔY = +189.9 m, and ΔZ = –121.6 m.

For the Maiana Datum of 1965, the Datum origin is at Maiana Astro 1965. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 173° 02' E, the False Easting = 20 km, and the False Northing = zero. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Maiana Datum of 1965 to WGS 84 Datum, the converted Doppler solution is ΔX = +215.5 m, ΔY = –27.9 m, and ΔZ = –159.7 m.

For the Marakei Datum of 1969, the Datum origin is at SW Point A where $\Phi_o$ = 01° 58' 58" S and $\Lambda_o$ = 173° 15' 22" East of Greenwich. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 173° 16' E, the False Easting = 10 km, and the False Northing = zero. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Marakei Datum of 1969 to WGS 84 Datum, the converted Doppler solution is ΔX = +188.1 m, ΔY = –237.6 m, and ΔZ = –185.6 m. The Operation ANON 1984-85 solution is ΔX = +188.7 m, ΔY = –229.9 m, and ΔZ = –189.3 m.

For the Nikunau Datum of 1965, the Datum origin is at third-order station NKZ 7 where $\Phi_o$ = 01° 23' 28.9196" S and $\Lambda_o$ = 172° 28' 46.4327" East of Greenwich. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 176° 27' E, the False Easting = 10 km, and the False Northing = 300 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Nikunau Datum of 1965 to WGS 84 Datum, the converted Doppler solution is ΔX = +229.8 m, ΔY = –38.4 m, and ΔZ = –311.7 m. The Operation ANON 1984-85 solution is ΔX = +230.3 m, ΔY = –17.7 m, and ΔZ = –315.3 m.

For the Nikunau Datum of 1959, the Datum origin is at Government Flagstaff where $\Phi_o$ = 01° 20' 44.37" S and $\Lambda_o$ = 176° 26' 31.36" East of Greenwich. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 176° 27' E, the False Easting = 10 km, and the False Northing = 300 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Nikunau Datum of 1965 to WGS 84 Datum, the converted Doppler solution is ΔX = +229.8 m, ΔY = –38.4 m, and ΔZ = –311.7 m. The Operation ANON 1984-85 solution is ΔX = +230.3 m, ΔY = –17.7 m, and ΔZ = –315.3 m.

For the Nonouti Datum of 1965, the Datum origin is at third-order station NNZ 14 where $\Phi_o$ = 00° 39' 57.7067" S, $\Lambda_o$ = 174° 26' 52.1428" East of Greenwich, and $H_o$ = 2.62 m. The local grid is based on the Transverse Mercator projection with the central meridian, λo = 174° 20' E, the False Easting = 20 km, and the False Northing = 200 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Nonouti Datum of 1965 to WGS 84 Datum, the converted Doppler solution is ΔX = +221.9 m, ΔY = –99.5 m, and ΔZ = –926.8 m. The Operation ANON 1984-85 solution is ΔX = +221.2 m, ΔY = –96.3 m, and ΔZ = –935.1 m. Note that the UTM coordinates of local traverses in 1963 of the Nououti Survey depend on the position A being $\varphi_o$ = 00° 40' 16.4" S and λo = 174° 27' 28" E.

For the Onotoa Datum of 1970, the Datum origin is at third-order station ONZ 7. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 175° 33' E, the False Easting = 10 km, and the False Northing = 350 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Onotoa Datum of 1970 to WGS 84 Datum, the converted Doppler solution is ΔX = +244.4 m, ΔY = +197.9 m, and ΔZ = –243.1 m. The Operation ANON 1984-85 solution is ΔX = +245.2 m, ΔY = +203.7 m, and ΔZ = –248.4 m.

For the Tabiteuea Datum of 1959, the Datum origin is at third-order station TBZ 1 Astro where $\Phi_o$ = 01° 28' 05.6" S and $\Lambda_o$ = 175° 03' 15.0" East of Greenwich. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 174° 53' E, the False Easting = 30 km, and the False Northing = 300 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Tabiteuea Datum of 1959 to WGS 84 Datum, the converted Doppler solution is ΔX = +250.8 m, ΔY = +235.6 m, and ΔZ = –377.2 m.

For the Tamana Datum of 1962, the Datum origin is at Astro Observation Spot where $\Phi_o$ = 02° 30' 09.0" S and $\Lambda_o$ = 175° 58' 45.8" East of Greenwich. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 175° 59' E, the False Easting = 10 km, and the False Northing = 400 km. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Tamana Datum of 1962 to WGS 84 Datum, the converted Doppler solution is ΔX = +202.3 m, ΔY = –181.6 m, and ΔZ = +128.2 m. The Operation ANON 1984-85 solution is ΔX = +206.8 m, ΔY = –159.8 m, and ΔZ = +95.7 m.

For the Tarawa Datum of 1966, the Datum origin is at first-order station Tarawa SECOR AMS 1966 where $\Phi_o$ = 01° 21' 42.13" N and $\Lambda_o$ = 172° 55' 47.27" East of Greenwich. The local grid is based on the Transverse Mercator projection with the central meridian, $\lambda_o$ = 173° 02' E, the False Easting = 20 km, and the False Northing = zero. The Scale Factor at Origin is unity ($m_o$ = 1.0). From Tarawa Datum of 1966 to WGS 84 Datum, the converted Doppler solution is ΔX = +176.0 m, ΔY = –421.8 m, and ΔZ = +282.3 m. The Operation ANON 1984-85 solution is ΔX = +184.0 m, ΔY = –356.3 m, and ΔZ = +287.5 m. For the Betio Anchorage Survey of 1959, note that the UTM coordinates of local traverses depend on the position C being $\varphi_o$ = 01° 19' 42.98" N and λo = 172° 58' 31.747" E.

For the Line Island group, according to John W. Hager, the origin is at Station Beacon on Kiritimati (Christmas Island) where $\Phi_o$ = 01° 59' 08" S and $\Lambda_o$ = 157° 29' 00" West of Greenwich. Established by N. J. Till, hydrographic surveyor, M.N.Z.I.S. in April-September 1941. English Harbor Observation Spot on Tabuaerau (Fanning Island) is the Datum origin where $\Phi_o$ = 03° 51' 23" N and $\Lambda_o$ = 159° 21' 50" West of Greenwich.

For the Phoenix Island Group, Birnie Island Astro is where $\Phi_o$ = 03° 35' 07.875" S and $\Lambda_o$ = 171° 31' 03.194" West of Greenwich. Kanton 1939 Datum at the American Eclipse Expedition Pier, USS Bushnel where $\Phi_o$ = 02° 49' 07.2" S and $\Lambda_o$ = 171° 42' 53.5" West of Greenwich. The position is described as a monolith on the western side of the island. Kanton 1963 is where $\Phi_o$ = 02° 47' 20.0" S ± 0.3", $\Lambda_o$ = 171° 39' 49.0" ± 0.3" West of Greenwich, and the reference azimuth is $\alpha_o$ = 75° 15' 19.15" ± 0.15" to CAN AZ1 from south (USC&GS second order). Canton Astro 1966 at Canton SECOR Astro is where $\Phi_o$ = 02° 46' 28.99" S ± 0.04", $\Lambda_o$ = 171° 42' 53.5" ± 0.05" West, and the azimuth is $\alpha_o$ = 385° 51' 02/65" ± 0.11" (SIC)

*continued on page 784*

*continued from page 783*

from SECOR RM-1 to TBM #3 (SECOR AZ MK) from South, referenced to the International 1909 ellipsoid. Enderbury Island Astro is where $\Phi_o$ = 03° 08' 30.140" S, $\Lambda_o$ = 171° 05' 34.95" West of Greenwich, and the reference azimuth is $\alpha_o$ = 179° 04' 00.69" to Bas. The Gardner Island Astro Datum is where $\Phi_o$ = 04° 40' 18.85" S, $\Lambda_o$ = 174° 32' 27.71" West of Greenwich, and the reference azimuth is $\alpha_o$ = 252° 25' 24.41" to station Line. The Hull Island Astro Datum is where $\Phi_o$ = 04° 29' 15.263" S, $\Lambda_o$ = 172° 10' 15.188" West of Greenwich, and the reference azimuth is $\alpha_o$ = 001° 50' 22.20" to station Base. The McKean Island Astro is where $\Phi_o$ = 03° 35' 51.375" S, $\Lambda_o$ = 174° 07' 37.522" West of Greenwich, and the reference azimuth is $\alpha_o$ = 005° 04' 59.26" to station North. The Phoenix Island Astro is where $\Phi_o$ = 03° 43' 13.375" S, $\Lambda_o$ = 170° 42' 56.004" West of Greenwich, and the reference azimuth is $\alpha_o$ = 309° 23' 37.76" to station South. Sydney Island Astro is where $\Phi_o$ = 04° 26' 57.975" S, $\Lambda_o$ = 171° 15' 43.885" West of Greenwich, and the reference azimuth is $A_o$ = 009° 45' 57.97" to station Nee. For both the Line Islands Group and the Phoenix Islands Group, the ellipsoid of reference is the Clarke 1966 unless otherwise noted.

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