

# Republic of Vanuatu

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

Inhabited for thousands of years by Melanesians before discovery by the Portuguese navigator Pedro Fernandes de Queirós, the islands were forgotten for 160 years and were then visited by the French navigator Louis-Antoine de Bougainville in 1768. The English mariner Captain James Cook explored the islands in 1774 and named it the New Hebrides. “The British and French, who settled the New Hebrides in the 19th century, agreed in 1906 to an Anglo-French Condominium, which administered the islands until independence in 1980.” What the World Factbook doesn’t say is that the local people referred to it as the Pandemonium!

Vanuatu \ vān-, -wā-tū \, is a group of more than 80 islands in the southwest Pacific Ocean northeast of New Caledonia and west of Fiji (*PE&RS*, October 2000). With a land area of 12,200 km<sup>2</sup>, the republic is slightly larger than Connecticut. Vanuatu has a tropical climate, the terrain is comprised mostly of volcanic mountains with narrow coastal plains, the lowest point is the Pacific Ocean, and the highest point is Tabwemasana (1,877 m) on the island of Espiritu Santo. The total coastline is 2,528 km and its maritime claims

are based (naturally) on archipelagic baselines. The exclusive economic zone is 200 nautical miles (NM), the territorial sea is 12 NM, the contiguous zone is 24 NM, and the continental shelf claim is 200 NM or to the edge of the continental margin – all of these claims are customary and are recognized under the International Law of the Sea.

In the Vanuatu Geodetic Control Network Report by Bakeeliu, Kanas, and Kalsale in June 2001, the network that began in the 1960s was generally detailed to the present. The Institute Géographique National (IGN) of France started their network in the 1960s. “The IGN network was made in two blocks, one of which covers the islands of Santo, Aoba, Pentecost, Maewo, Ambrym, Malekula Epi, Éfaté in the northern part of Vanuatu while the other block covers Erromango, Tanna, Anatom and the nearby small islands in the south. The islands left

out were the Banks and Torres group in the far north of Vanuatu.” The report continues, “The IGN [*datum – Ed.*] was based on the astronomical observation made at Bellevue on Éfaté.” (Note that another common spelling for the island of Éfaté is Île Vaté ). The Vanuatu (IGN) 1960 Datum origin coordinates at Bellevue are  $\Phi_0 = 17^\circ 44' 17.40''$  South,  $\Lambda_0 = 168^\circ 20' 33.25''$  East of Greenwich, and the ellipsoid of reference is the International 1909 (Madrid 1924) where  $a = 6,378,388$  m, and  $1/f = 297$ . The National Geospatial Intelligence Agency (NGA) lists the transformation parameters from The Vanuatu (IGN) 1960 Datum (Bellevue) to the WGS84 Datum as  $\Delta a = -251$  m,  $\Delta f = -0.14192702$ ,  $\Delta X = -127$  m  $\pm 20$  m,  $\Delta Y = 769$  m  $\pm 20$  m, and  $\Delta Z = +472$  m  $\pm 20$  m. This relation is based on observations at three stations. John W. Hager, retired from what is now NGA says, “The trans-

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formation states that it is for the islands of Éfaté and Erromango but my notes imply that the trig list applies from Éfaté to Espiritu Santo. Source for this is ‘Loose Minute, MCE Ht/KHG/PL, 10 July 1970 with one page from I.G.N. Trig list.’ I don’t remember what all the letters mean but it was a letter from the British Military to U.S. Army Topographic Command.” Hager also commented that, “Pier Observation Spot, Vila Harbor, Éfaté Island. I have no data but questioned for my further investigation whether it was Fila or Vila, Fila possibly being a corruption of Éfila.” Presumed datum point is S. T. 1 (Service Topographique) at latitude  $15^\circ 17' 16''$  S., longitude  $167^\circ 58' 34''$  E. This was taken from ‘Traverse Around Perimeter of Aoba Island,’ 30 Sept. 1969.” He found a 1949 IGN reference to a local grid for the Aoba Island Datum where False Northing = 12,000 meters and False Easting = 18,000 meters. Accord-

ing to Hager, “the only odd map projection I find is for Nouvelles Hébrides, Fuseau Calédonie-Hébrides, Gauss projection, [*Transverse Mercator – Ed.*], International ellipsoid, meter, latitude of origin = equator, longitude of origin =  $167^\circ$  E, scale factor unknown but probably unity, false northing (y) = 2,600,000 meters, false easting (x) = 1,000,000 meters. This is from ‘Catalogue de Cartes en Service Publiées par l’Institute Géographique National,’ Paris, 1 July 1949.”

Referring back to the Vanuatu Geodetic Control Network Report, “The adjustment used by DOS [*Directorate of Overseas Surveys, UK – Ed.*] was initiated from the same points as the IGN however the astronomical observations and adjustment was done separately. The DOS adjustment covers the islands of Santo, Aoba, Maewo, Pentecost, Ambrym, Malekula and Pamma in the north

and Éfaté, Erromango, Tanna, Anatom and Futuna in the south. The DOS however extended its triangulation further throughout the country covering and strengthening the network to other islands, except Bank and Tores in the far north. This adjustment was used for mapping as well as cadastral. DOS adjustment

uses the same scale factor of one (1.00000) throughout the country, though each island has its own origin.”

Continuing, early in the “1980s the Vanuatu Government attempted to connect the DOS north and south block using traverse methods with the introduction of Tellurometer distance measurements. However, it was found that there was some discrepancy between the two blocks. It was uncertain then that the error was in the traverse observation or the astronomical observation of the two blocks. It was also difficult to undertake alternative method of triangulation as the sights between Epi and Emae islands was very difficult. It was seen that it may be easier if a triangulation was done through the islands between the two blocks, however for some reason this was not done. The technology at that time may

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also be the cause of the inaccuracy of the observations. In mid 1990s the Australian Government assisted the Vanuatu Government by providing funds, technology and human resources through the Australian Defense Cooperation to run a Doppler network that covers the whole country. This has enabled the Vanuatu Government to anticipate the strengthening of the country's survey control network on the WGS72 spheroid. The network was produced to control the aerial photography of the country. For cadastral purposes the DOS geodetic adjustment is still maintained."

I asked Russell Fox, now retired from the International Geodetic Library of the Ordnance Survey International, United Kingdom, if he had anything to help me on my column on Vanuatu. To my (usual) surprise, he certainly did have something. Fox had worked there for three years! "The Condominium (known as the Pandemonium locally) was a strange form of government, the British and French running parallel but separate administrations in the same territory (so not analogous with St. Maarten/St. Martin). There were French and British police forces, hospitals, schools, etc. Residents had to use "their" facilities. Citizens of countries other than Britain (& Commonwealth) or France had to opt for either honorary British or honorary French status and use the appropriate services. This split the local people also, half of whom were educated in the French milieu and half in British traditions. There was "trouble in paradise," as the newspapers put it, during the immediate pre-and post-independence period, as the more radical and pro-independence English-speaking ni-Vanuatu jostled for power with the French speakers and French settlers, who preferred the status quo (not least because French plantation owners would be most affected by proposed changes in land tenure)."

Fox continued, "I worked in Vanuatu from 1983-86. Independence had come in 1980, so I did not personally witness this, but one of the Survey Department's tasks pre-independence was to measure the heights of the flagstaves at the British and French Residencies in Port Vila. There would have been a diplomatic incident if either the Union Jack or the Tricolore had been flown slightly higher than the other! The Condominium was the result of Anglo-French rivalry in the Pacific during the late 19<sup>th</sup> century; I believe that the Australian colonies were particu-

larly keen to avoid a French takeover of the New Hebs as well as New Caledonia and they lobbied the British Govt. to do something about it. The answer was Condominium, if only to avoid an Anglo-French war. Another Condominium was the Anglo-Egyptian Sudan. The WWII US presence in the New Hebs was still evident in the 1980s, with 6-wheel trucks on plantations, USN dustbins [galvanized trash cans?] being used as water containers and metal plates from airfield runways being used as property fences." [*I remember seeing the same things when I lived in Panamá – Ed.*]

"The main post-1978 survey activities I know of were: 1980 – A dozen Doppler stations were observed by 512 Specialist Team, Royal Engineers. 1983-86 'Operation Algum' – major support for the Survey Department was received from the Royal Australian Survey Corps. This involved a Doppler campaign throughout the islands, new aerial photography, readjustment of the DOS and IGN trig networks on WGS84 and setting up a map production facility in the Survey Department. 1980s-1990s New Editions of the DOS 1:1,000,000 map were produced by the Survey Department, also a new 1:50,000 series. The Vanuatu Map Grid was introduced, a national TM projection to replace the assorted island grids that existed previously. The Survey Department produced a brief paper in about 1976/77 that discussed the significant differences between DOS and IGN positions in the New Hebs (nearly a km in the northern islands if I recall correctly). Those discrepancies weren't solved – or circumvented – until OP Algum, but the Survey Department did develop a TM grid (called Éfaté TM 77) for the main island, Éfaté or (Vaté), in 1977 to improve the control situation there by unifying disparate surveys and replacing the old Cassini grid. Both DOS and IGN used International Spheroid, but had datums in different places, and trig block boundaries in different places – the DOS North Block was islands North of Éfaté, and South Block was Éfaté and islands south. IGN had a North Block (Éfaté and islands North) and South Block (Erromango to Aneityum). I think the most northerly island in the New Hebs, the Banks and Torres Islands, were not reached by either the DOS or IGN networks and had local astro fixes only."

The National Geospatial Intelligence Agency (NGA) lists the transformation parameters from the Santo (DOS) 1965 Datum (Espiritu Santo Island) to the WGS84 Datum

as:  $\Delta a = -251\text{m}$ ,  $\Delta f = -0.14192702$ ,  $\Delta X = +170\text{m} \pm 25\text{m}$ ,  $\Delta Y = +42\text{m} \pm 25\text{m}$ , and  $\Delta Z = +84\text{m} \pm 25\text{m}$ . This relation is based on observations at one station. Thanks to John W. Hager; Russell Fox; Tony Kanas, surveyor; and, the Vanuatu Department of Land Surveys for their generous assistance.



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