An update on the status of PNG94

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Geodetic Section, Office of Surveyor General,
Department of Lands & Physical Planning

46th Association of Surveyors of Papua New Guinea Congress, Port Moresby, 1-3 August 2012

Status at the ASPNG Congress in 2008

- Geodetic Section not funded or supported by OSG
- No proposal for PNG94 densification and support
- unserviceable GPS equipment (15 year old receivers)
- No computing facilities or software
- No staff training and support
- PNG94 datum maintenance undertaken by private sector!

Situation in 2012

- Geodetic Section now fully supported by OSG
- Improvement of PNG94 with inclusion of validated data from private sector and geodynamics studies
- Procurement of 3 Leica GS15 GNSS receivers and total station
- Procurement of Leica GNSS base station at NMB (NMB2 base station) – on the APREF network
- Leica Geo Office – for data processing
- Funding for geodetic control densification & border surveys

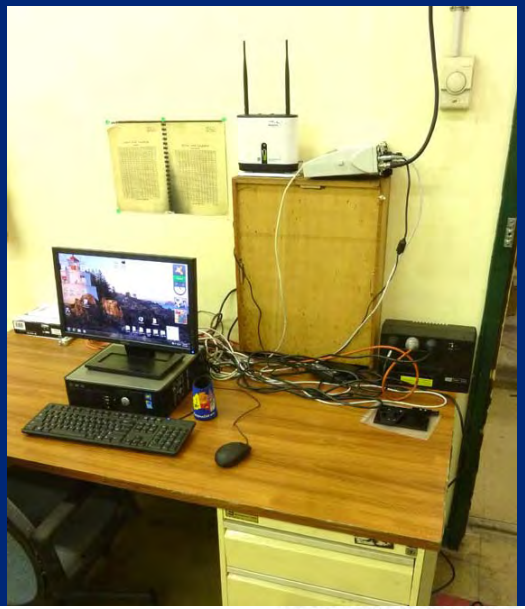
Geodetic Section acquires 3 new Leica GS15 receivers

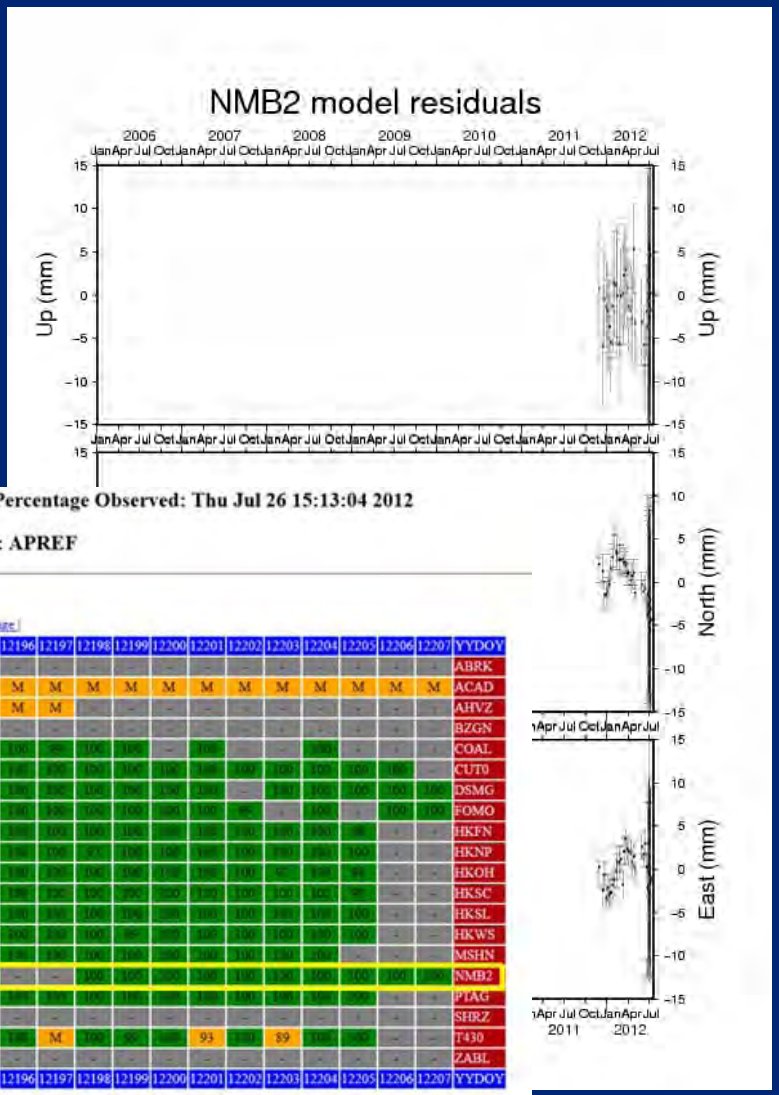
and Flexline Total Station

New GNSS base station on APREF (NMB2)

Leica GRX1200+ GNSS receiver and AR10 antenna

NMB2 performance





DAILY RINEX Data in /nas/gemd/geodesy_data/ - Percentage Observed: Thu Jul 26 15:13:04 2012

NETWORK : APREF

NETWORKS : | All Stations | IPS | APREF | NTLANDS | SPRGN | SUNPOS | NGS | VICNET | GEONET | IGS | NSWNET | ARGN |

Combined Epochs and Observed Percentage | Cycle Slip Ratio | Average MP1 | Average MP2 | Observed Percentage | Epoch Percentage |

YYDOY	12178	12179	12180	12181	12182	12183	12184	12185	12186	12187	12188	12189	12190	12191	12192	12193	12194	12195	12196	12197	12198	12199	12200	12201	12202	12203	12204	12205	12206	12207	YYDOY
ABRK	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ABRK
ACAD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	M	-	M	M	M	M	M	M	M	M	M	M	M	M	M	ACAD
AHVZ	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	-	-	-	-	-	-	-	-	-	-	AHVZ
BZGN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BZGN
COAL	M	M	M	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	100	-	100	-	-	100	-	-	-	COAL
CUT0	100	100	100	100	100	100	100	100	100	100	100	100	100	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-	CUT0
DSMG	M	M	M	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-	100	100	100	100	100	-	DSMG
FOMO	M	M	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	-	100	-	100	100	-	FOMO
HKFN	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	98	-	-	-	HKFN
HKNP	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	97	100	100	100	100	100	100	100	-	-	-	HKNP
HKOH	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	98	-	-	HKOH
HKSC	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	98	-	-	HKSC
HKSL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-	-	HKSL
HKWS	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-	-	HKWS
MSHN	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-	-	-	MSHN
NMB2	100	100	100	100	100	100	100	100	100	100	100	100	100	M	100	-	100	100	-	-	100	100	100	100	100	100	100	100	100	100	NMB2
PTAG	100	100	100	100	100	100	100	100	100	100	100	100	100	M	-	100	100	100	100	100	100	100	100	100	100	100	100	100	-	-	PTAG
SHRZ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SHRZ
T430	100	100	100	100	100	100	100	100	100	100	100	90	84	99	100	100	100	100	100	M	100	99	100	93	100	89	100	100	-	-	T430
ZABL	100	100	100	100	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ZABL
YYDOY	12178	12179	12180	12181	12182	12183	12184	12185	12186	12187	12188	12189	12190	12191	12192	12193	12194	12195	12196	12197	12198	12199	12200	12201	12202	12203	12204	12205	12206	12207	YYDOY

NMB2 and APREF (Asia Pacific Reference Frame)

Cartesian Coordinates and Velocities (ITRF2008)

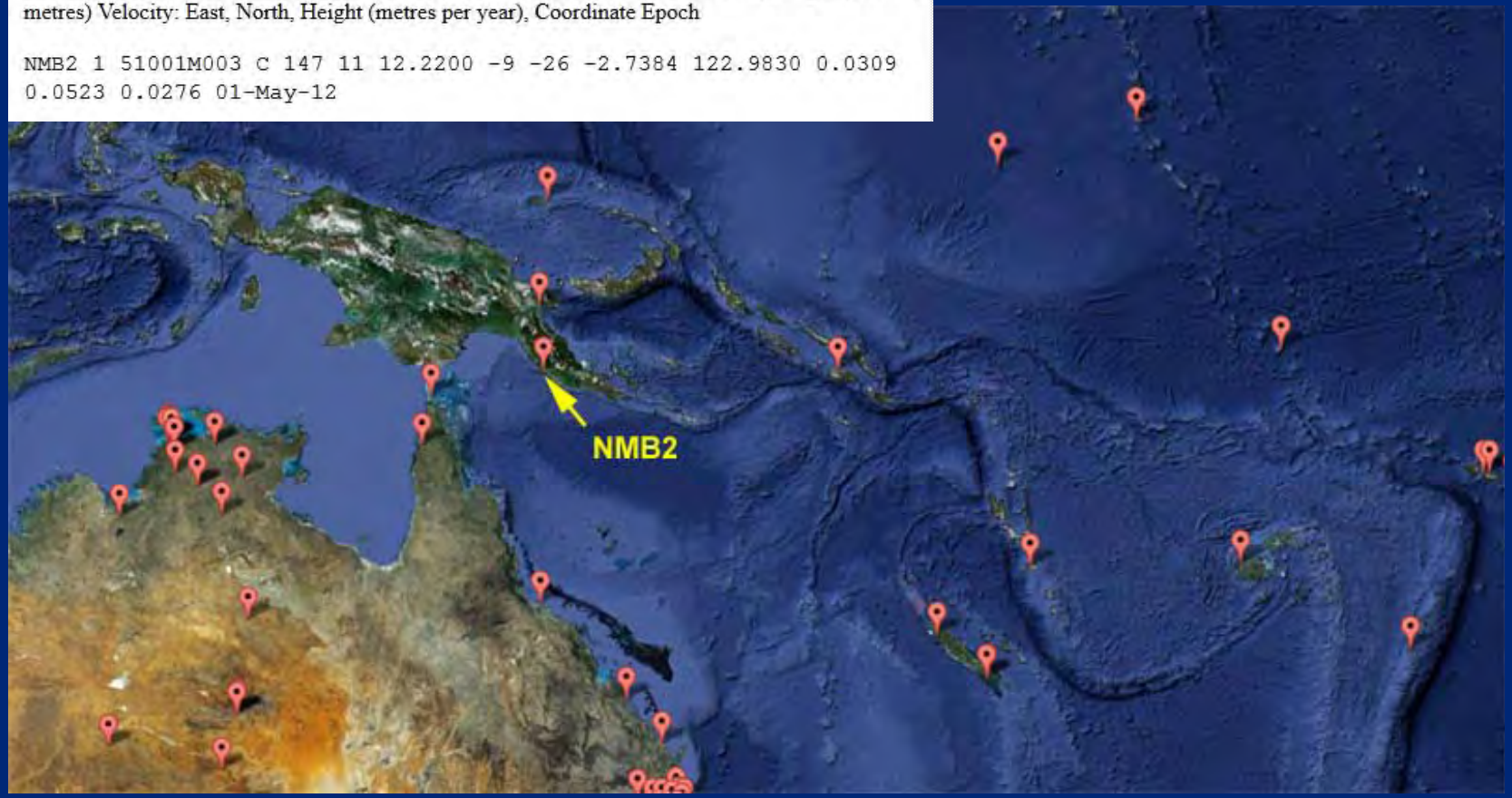
Position: X, Y, Z (metres), Velocity: X, Y, Z (metres per year), Coordinate Epoch

```
NMB2 1 51001M003 C -5288524.8937 3409955.8286 -1038574.3978
-0.0468 -0.0065 0.0470 01-May-12
```

Geodetic Coordinates and Velocities (ITRF2008)

Position: longitude (degrees minutes seconds), latitude (degrees minutes seconds), height (GRS80, metres) Velocity: East, North, Height (metres per year), Coordinate Epoch

```
NMB2 1 51001M003 C 147 11 12.2200 -9 -26 -2.7384 122.9830 0.0309
0.0523 0.0276 01-May-12
```



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Papua New Guinea Geodetic Datum 1994 (PNG94)

PNG94 is the gazetted national datum for Papua New Guinea (National Gazette of 22 May 1996). PNG94 is realised by the coordinates of 14 zero order geodetic stations within Papua New Guinea (listed below) related to the International Terrestrial Reference Frame 1992 (ITRF92) at epoch 1994.0 (same as GDA94 in Australia).
It is defined as follows:

Reference Ellipsoid: GRS80
Map Projection: Papua New Guinea Map Grid 1994 (PNGMG94)
Projection type: Universal Transverse Mercator (UTM)

Usage:
PNG94 should be used as the geodetic datum for all cadastral, topographical, engineering and resource sector surveys commenced after 2000.

Access:
Surveys should be connected to the nearest high order PNG94 control. This can be by means of connection to a PNG94 coordinated monument, or to a CORS station. Because of the highly complex tectonic setting in PNG, the closest coordinated monument should be used for connection.

First Order Coordinate Listing:
Click on the link **PNG94 1st order adjustment 2008 (update 1st December 2011)** to view and download the spreadsheet of the current first order coordinate list for PNG94. The adjustment has resulted in small changes in the original zero order PNG94 realisation (listed in the table below). The data area also provided as a Google Earth kml file

Site and access information for these stations (and others) are available at the Australian National University Research School of Earth Sciences:
PNG GPS Site Information
Note that the coordinates in these site logs are ITRF2000 at epoch 2000.0 and may be up to 0.5 m different from the PNG94 values.

Using PPP, AusPOS and OmniSTAR with PNG94:
These GNSS precision surveying systems and post-processing services deliver coordinates in terms of ITRF2005 or ITRF2008 and these coordinates will be up to two metres different from PNG94. A block-shift correction to be applied to derived coordinates from these systems can be determined by occupation of the nearest PNG94 coordinated monument.

Coordinate transformations:
Since PNG94 and GDA94 share the same realisation, the GDA94 technical manual can be used with PNG94 (substitute PNG94 for

PNG94 on the web

ASPNG web-site

- Coordinates
- Site Information
- Station sketches (for 1st order control – soon)
- Technical Manual
- Guidance
- Google Earth file

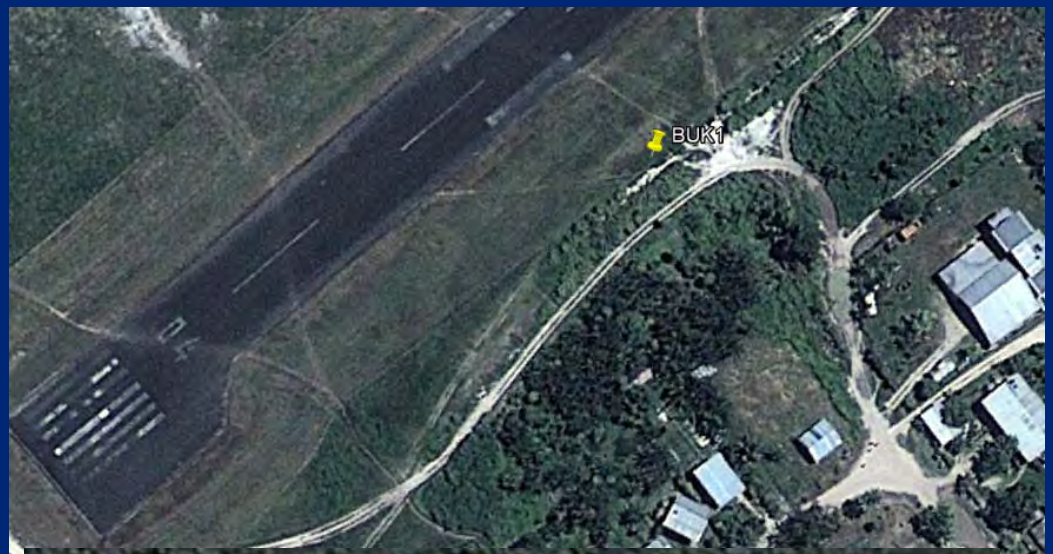
PNG94 First Order Control

PNG94 (ITRF92 at epoch 1994.0) - 1st order control - Adjustment 7th June 2008 - Updated 1st December 2011

Station location			PNG94 Ellipsoidal Coordinates							PNGMG94 Grid Coordinates			MSL RL (PNG08)	ITRF Site Velocity		PNG94	
Location	GPS ID	NMB Number	Latitude			Longitude			Ellipsoid Height	Zone	Easting	Northing		E m/yr	N m/yr	Latitude Decimal	Longitude Decimal
Aiambak	AIAM	PSM 9550	-7	20	51.8206	141	16	1.4470	95.52	54	529475.73	9187801.94	21.20	0.037	0.058	-7.34772794	141.26706861
Alotau - Gurney Airport	ALT2	PSM 9538	-10	18	37.5094	150	20	18.0912	94.87	56	208478.37	8859053.57	16.37	0.031	0.058	-10.31041928	150.33835867
Bululo - Unitech Weather	BULO	PSM 32629	-7	12	25.0357	146	37	32.2264	802.11	55	458667.37	9203356.01	722.94	0.027	0.058	-7.20695436	146.62561844
Buka Airport	BUK1	PSM 4871	-5	25	34.3712	154	40	8.4373	73.25	56	684918.22	9399967.57	2.87	-0.059	0.031	-5.42621422	154.66901036
Daru - Airport	DARU	AA 440/A	-9	5	15.5229	143	12	27.1952	80.28	54	742639.83	8994719.42	5.28	0.035	0.055	-9.08764525	143.20755422
Finschhafen	FINS	PSM 19471	-6	36	55.4209	147	51	17.6868	74.24	55	594504.66	9268686.35	7.42	-0.006	0.004	-6.61539469	147.85491300
Gobe - Airport	GOBE	PSM 15262	-6	52	45.5700	143	43	21.3500	129.24	54	800901.00	9238734.50	50.98	0.034	0.054	-6.87932500	143.72259722
Goroka - Airport	GOKA	PSM 9833	-6	4	53.0717	145	23	30.4470	1664.47	55	322023.98	9327531.64	1584.83	0.023	0.046	-6.08140881	145.39179083
Hoskins - Airport	HOSK	PSM 9795	-5	28	0.4073	150	24	31.6614	101.35	56	212869.72	9395119.32	18.42	0.022	-0.027	-5.46677981	150.40879483
Kavieng - Airport	KAVI	PSM 9513	-2	34	53.0660	150	48	22.5361	78.81	56	256077.96	9714464.61	2.85	-0.067	0.027	-2.58140722	150.80626003
Kenabot - Lands Base	KENB	PSM 23342	-4	20	45.1168	152	16	7.9951	136.69	56	418875.65	9519602.79	63.12	-0.002	-0.041	-4.34586578	152.26888753
Kerema - Catholic Mission	KERE	PSM 31703	-7	57	28.0191	145	46	19.0726	97.57	55	364647.58	9120168.45	21.32	0.030	0.052	-7.95778308	145.77196461
Kikori - Airport	KIKO	PSM 5583	-7	25	24.6531	144	14	55.7677	88.93	55	196298.45	9178490.00	12.38	0.035	0.054	-7.42351475	144.24882436
Kiunga - Airport	KIU3	PSM 32685	-6	7	28.3824	141	17	12.2347	112.45	54	531725.31	9323018.83	37.48	0.038	0.056	-6.12455067	141.28673186
Kumul - Oil Export Platform	KU34	Kumul 34	-8	3	51.3916	144	33	38.3558	103.3	54	892563.96	9106883.55	28.22	0.035	0.054	-8.06427544	144.56065439
Lae - Unitech DSLS Base	LAE1	PSM 31107	-6	40	25.3661	146	59	35.4668	140.37	55	499246.79	9262320.80	67.45	0.026	0.052	-6.67371281	146.99318522
Lae - Unitech Sports	9799	PSM 9799	-6	40	16.9707	146	59	52.3754	130.31	55	499765.91	9262578.60	57.40	0.026	0.052	-6.67138075	146.99788206
Lake Kopiago - Airport	KOPI	PSM 17001	-5	23	9.0852	142	29	42.1907	1412.79	54	665650.98	9404480.51	1329.45	0.031	0.055	-5.38585700	142.49505297
Losuia	LOSU	AA 583	-8	32	7.2596	151	7	30.8181	85.16	56	293644.60	9056016.40	5.61	0.021	0.071	-8.53534989	151.12522725
Madang - Airport	MAD1	GS 15495	-5	12	41.2891	145	46	56.1940	73.27	55	365044.17	9423829.87	4.95	0.023	0.039	-5.21146919	145.78227611
Manus - Lombrum Secor	MANU	PSM 9522	-2	3	2.2944	147	21	37.6363	129.77	55	540084.32	9773337.48	50.77	-0.065	0.027	-2.05063733	147.36045453
Mendi - Airport	MEND	PSM 3507	-6	8	36.7344	143	39	22.1658	1815.08	54	793981.21	9320198.80	1732.11	0.029	0.047	-6.14353733	143.65615717
Misima - Airport	MIS1	PSM 9195	-10	41	19.9049	152	49	58.9388	87.46	56	481741.61	8818417.91	12.70	0.030	0.055	-10.68886247	152.83303856
Moro - Airport	MORA	PSM 17442	-6	21	44.9072	143	13	46.0940	917.86	54	746627.49	9296194.53	837.64	0.033	0.054	-6.36247422	143.22947056
Mount Hagen - Airport	HGEN	PSM 3419	-5	49	55.7591	144	18	23.7948	1710.15	55	201725.79	9354636.51	1626.57	0.030	0.048	-5.83215531	144.30660967
Nadzab - Airport	NADZ	ST 31024	-6	33	47.9879	146	43	39.6541	148.83	55	469894.96	9274514.88	76.13	0.024	0.056	-6.56332997	146.72768169
Namatanai - Airport	NAMA	GS 19461	-3	39	58.5422	152	26	6.1582	114.96	56	437261.32	9594742.59	42.81	-0.061	0.001	-3.66626172	152.43504394
Nogoli Hides - Helipad	NOGO	PSM 30041	-5	56	2.4348	142	47	16.7455	1340.2	54	697930.59	9343770.78	1258.04	0.032	0.054	-5.93400967	142.78798486
Pomio	JACQ	PSM 9515	-5	38	42.9782	151	30	19.6067	151.55	56	334476.29	9375795.22	77.26	0.020	-0.053	-5.64527172	151.50544631
Popondetta	POPN	PSM 9371	-8	46	9.6499	148	14	0.3966	187.53	55	635667.54	9030425.34	105.82	0.024	0.054	-8.76934719	148.23344350
Port Moresby - NMB Base	NMB2	PSM 31927	-9	26	2.7697	147	11	12.2000	123.02	55	520498.37	8957148.59	47.17	0.028	0.053	-9.43410269	147.18672222
Rabaul - RVO Base	RVO_	RVO	-4	11	27.1915	152	9	49.5108	266.24	56	407190.52	9536723.33	191.46	0.007	-0.052	-4.19088653	152.16375300
Tabubil - Airport	TAB2	PSM 32695	-5	16	45.0122	141	13	38.9016	559.82	54	525205.42	9416471.93	478.52	0.036	0.055	-5.27917006	141.22747267
Tari - Airport	TARI	T630	-5	50	37.7496	142	56	45.8643	1755.79	54	715472.19	9353687.25	1672.91	0.031	0.053	-5.84381933	142.94607342
Tokua - Airport	TOKU	GS 9822	-4	20	27.7832	152	22	45.8215	82.05	56	431137.64	9520146.01	10.11	-0.010	-0.036	-4.34105089	152.37939486
Tufi - Hospital	TUFI	PSM 7518	-9	4	46.4549	149	19	22.2495	99.44	55	755324.26	8995533.60	20.14	0.027	0.056	-9.07957081	149.32284708
Vanimo - Doppler	VANI	PM 63/1	-2	41	5.2819	141	18	15.6562	80.59	54	533829.65	9703242.49	2.20	0.013	0.045	-2.68480053	141.30434894
Wankkun - Pillar	NM34	NM/J/34	-6	8	52.0739	146	4	52.4422	509.98	55	398344.12	9320370.15	435.85	0.026	0.047	-6.14779831	146.08123394
Wafi - Helipad	WAF1	PSM 32631	-6	51	54.6238	146	26	58.8693	501.56	55	439199.05	9241120.81	425.57	0.032	0.054	-6.86517328	146.44968592
Wau - Airport	WAUA	GS 9840	-7	20	48.5674	146	43	2.8288	1193.56	55	468815.82	9187900.80	1112.92	0.025	0.056	-7.34682428	146.71745244
Wewak - Airport	WEWK	PSM 15497	-3	35	2.5848	143	40	0.1481	83.91	54	796268.18	9603418.22	4.85	0.017	0.053	-3.58405133	143.66670781
Woodlark - Guasopa	GUA1	PSM 9519	-9	13	30.0049	152	56	37.3585	78.64	56	493816.89	8980271.66	1.61	0.020	0.078	-9.22500136	152.94371069
Wuvulu	WUVU	PSM 15456	-1	44	7.5951	142	50	10.0781	79.03	54	704257.66	9808081.66	1.34	-0.068	0.019	-1.73544308	142.83613281

PNG94 Google Earth

PNG94 1st order control on Google Earth



Geodetic Section – work flow 2012 and 2013

- 1st order control at every Airport, township (at government office or school) and resource location
- Site velocity model for transformation between ITRF2008 and PNG94 (Richard Stanaway) for inclusion in AusPOS
- GNSS at Tide Gauges to determine offset between EGM2008, MSL, LAT and HAT (to improve PNG08 model)
- 1st order Geodetic control station summaries (PSM sketches) available free of charge from ASPNG web-site
- continue DCDB control connection work
- finalise AGD66 to PNG94 transformation parameters

What can the geodetic section do for you?

- Provide PNG94 control connection to your survey

  (in some instances this may be free of charge, otherwise charges will be minimal)

- NMB2 base station data for surveys in POM, Oro and Central Province

  (K200 for 24 hrs of Rinex data and Nav file at 30 second epoch interval)

- Process static GNSS data to obtain PNG94 and MSL

  (free or minimal charge on the proviso that a PSM is established and sketch provided)

- Geodetic surveys for resource sector projects

  (charged according to ASPNG scale of fees)

- Provide guidance and PSM numbers

Key personnel: John Kwasi, John Oa, Richard Stanaway

What you can do for PNG Geodesy!

- Connect all your surveys to PNG94 1st order control
- Submit PSM sketches!!! **Many hundreds not provided.**
- Provide GNSS static data on existing 1st order stations (8 hrs + data for these will be processed for free !)

  (email this data to Richard Stanaway for free PNG94 derivation until online facility becomes active)
- Maintain survey control and witness posts in your area

  (replace witness posts and do a sketch showing new connections)
- Get PSM numbers for good quality stations

Geodetic PSMs are the fundamental physical infrastructure of PNG!

Contact details

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Thank you !