

## AUSPOS Online GPS Processing Report

Space Geodesy Analysis Centre  
The National Mapping Division (NMD), Geoscience Australia

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This document is a report of the GPS data processing undertaken by the AUSPOS Online GPS Processing Service. The AUSPOS Online GPS Processing Service uses International GPS Service (IGS) products (final, rapid, ultra-rapid depending on availability) including Precise Orbits, Earth Orientation, Coordinate Solutions (IGS-SSC) to compute precise coordinates in ITRF anywhere on Earth. The Service is designed to process only dual frequency GPS phase data.

The AUSPOS Online GPS Processing Service is a free service and you are encouraged to use it for your projects. However, you may not charge others for this service. Geoscience Australia does not warrant that this service a) is error free; b) meets the customer's requirements. Geoscience Australia shall not be liable to the customer in respect of any loss, damage or injury (including consequential loss, damage or injury) however caused, which may arise directly or indirectly in respect of this service.

An overview of the GPS processing strategy is attached to this report. Please direct email correspondence to [geodesy@auslig.gov.au](mailto:geodesy@auslig.gov.au)

AUSPOS Project Manager

Space Geodesy Analysis Centre  
The National Mapping Division  
Geoscience Australia  
Scrivener Building, Dunlop Court, Fern Hill Park, Bruce ACT 2617  
PO Box 2, Belconnen ACT 2616, Australia  
Freecall (Within Australia): 1800 800 173.  
Tel: +61 2 6201 4201. Fax: +61 2 6201 4366  
The National Mapping Division Home Page: [www.auslig.gov.au](http://www.auslig.gov.au)

Job number: #8586; User: [john dawson@auslig.gov.au](mailto:john dawson@auslig.gov.au) AUSPOS version 1.01.19

# 1 User and IGS GPS Data

All antenna heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP).

User File	Antenna Type	Antenna Height (m)	Start Time	End Time
test1770.00o	DEFAULT(NONE)	0.0000	2000-06-25 04:01:59	2000-06-25 05:08:00

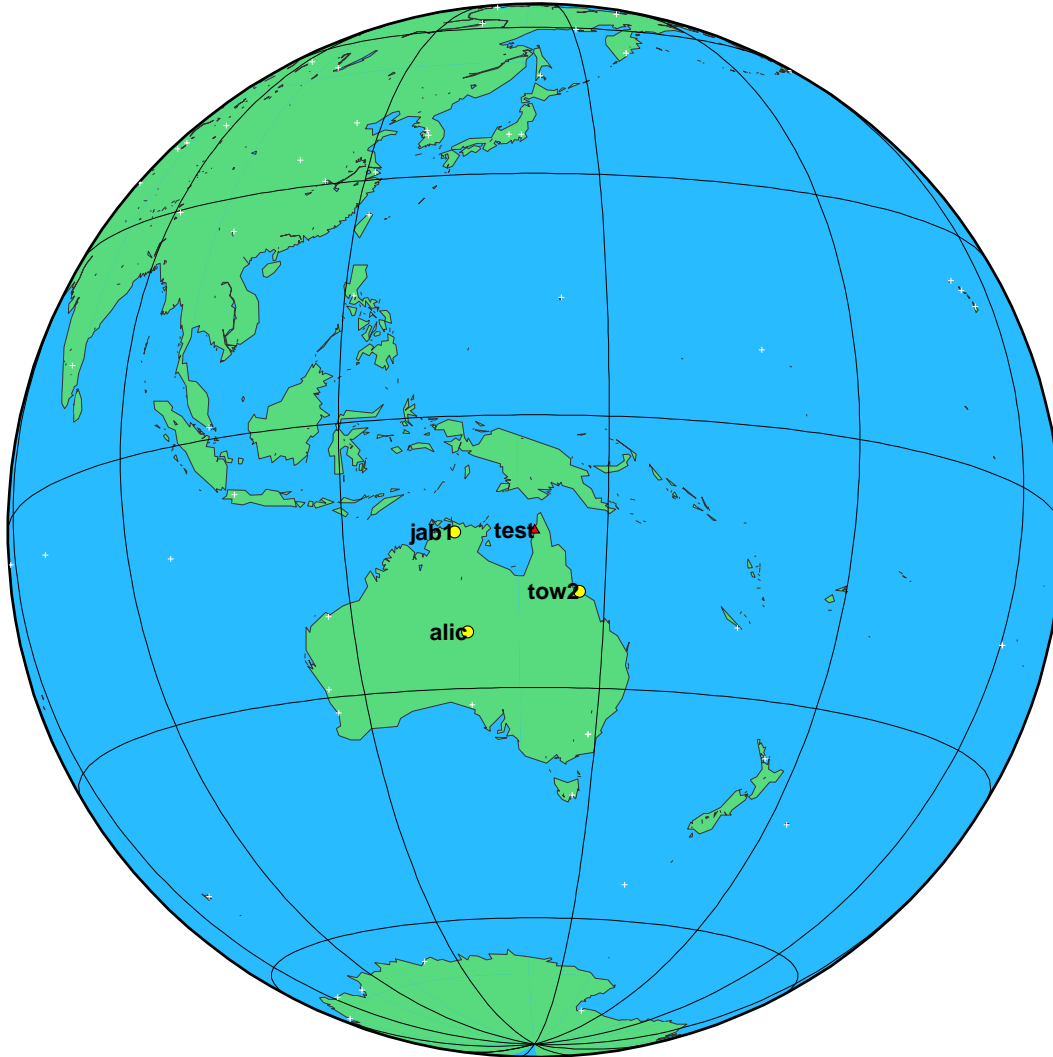


Figure 1: Global View – submitted GPS station(s) and nearby IGS GPS stations used in the processing; triangle(s) represent submitted user data; circle(s) represent the nearest available IGS stations.

## 2 Processing Summary

Date	IGS Data	User Data	Orbit Type
2000-06-25	tow2 jab1 alic	test	IGS Final

## 3 Computed Coordinates, GDA94

For Australian users Geocentric Datum of Australia (GDA94, ITRF92@1994.0) coordinates are provided. GDA94 coordinates are determined from ITRF coordinates by an Geoscience Australia (GA) derived coordinate transformation process. GA transformation parameters between ITRF and GDA94 are re-computed weekly, incorporating the latest available tectonic motions (determined from the GA GPS network). GA recommends that users within Australia use GDA94 coordinates. All coordinates refer to the Ground Mark. For general/technical information on GDA94 see [www.auslig.gov.au/geodesy/datums/gda.htm](http://www.auslig.gov.au/geodesy/datums/gda.htm) and [www.anzlic.org.au/icsm/gdatm/](http://www.anzlic.org.au/icsm/gdatm/)

### 3.1 Cartesian, GDA94

	X(m)	Y(m)	Z(m)	
tow2	-5054582.667	3275504.568	-2091539.894	GDA94
alic	-4052051.761	4212836.201	-2545106.025	GDA94
jab1	-4236442.748	4559929.726	-1388624.827	GDA94
test	-4895452.540	3844023.180	-1388048.136	GDA94

### 3.2 Geodetic, GRS80 Ellipsoid, GDA94

The height above the Geoid is computed using the GPS Ellipsoidal height and subtracting a Geoid-Ellipsoid separation. Geoid-Ellipsoidal separations are computed using a bilinear interpolation of the AUSGeoid98 grid. The height above the Geoid is only provided for sites within the AUSGeoid98 extents. For information on AUSGeoid98 see [www.auslig.gov.au/geodesy/ausgeoid/geoid.htm](http://www.auslig.gov.au/geodesy/ausgeoid/geoid.htm)

	Latitude(DMS)		Longitude(DMS)		Ellipsoidal Height(m)	Above-Geoid Height(m)	
tow2	-19-16	-9.4283	147 3	20.4653	88.225	30.136	GDA94
alic	-23-40	-12.4461	133 53	7.8478	603.344	587.667	GDA94
jab1	-12-39	-31.8751	132 53	38.0196	82.237	27.186	GDA94
test	-12-39	-12.6693	141 51	36.6217	78.431	13.878	GDA94

### 3.3 MGA Grid, GRS80 Ellipsoid, GDA94

	East(M)	North(M)	Zone	Ellipsoidal Height(m)	Above-Geoid Height(m)	
tow2	505851.329	7869375.314	55	88.225	30.136	GDA94
alic	386352.396	7381850.767	53	603.344	587.667	GDA94
jab1	271256.226	8599668.194	53	82.237	27.186	GDA94
test	593409.195	8601026.169	54	78.431	13.878	GDA94

## 4 Computed Coordinates, ITRF2000

All computed coordinates are based on the IGS realisation of the ITRF2000 reference frame, provided by the IGS cumulative solution. All the given ITRF2000 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

### 4.1 Cartesian, ITRF2000

	X(m)	Y(m)	Z(m)	ITRF2000 @
tow2	-5054582.814	3275504.408	-2091539.532	2000/06/25
alic	-4052051.981	4212836.102	-2545105.663	2000/06/25
jab1	-4236442.930	4559929.563	-1388624.449	2000/06/25
test	-4895452.683	3844022.990	-1388047.760	2000/06/25

## 4.2 Geodetic, GRS80 Ellipsoid, ITRF2000

The height above the Geoid is computed using the GPS Ellipsoidal height and subtracting a Geoid-Ellipsoid separation. Geoid-Ellipsoidal separations, in this section, are computed using a spherical harmonic synthesis of the global EGM96 geoid. More information on the EGM96 geoid can be found at [www.nima.mil/GandG/wgsegm/egm96.html](http://www.nima.mil/GandG/wgsegm/egm96.html)

	Latitude(DMS)		Longitude(DMS)			Ellipsoidal Height(m)	Above-Geoid Height(m)
tow2	-19-16	-9.4168	147	3	20.4727	88.140	30.093
alic	-23-40	-12.4342	133	53	7.8558	603.273	587.956
jab1	-12-39	-31.8630	132	53	38.0277	82.158	27.821
test	-12-39	-12.6574	141	51	36.6296	78.344	14.069

## 5 Solution Information

To validate your solution you should check the :-

- i. Antenna Reference Point (ARP) to Ground Mark records;
- ii. Apriori Coordinate Updates (valid range is 0.000 - 15.000 m);
- iii. Coordinate Precision (valid range is 0.001 - 0.025 m);
- iv. Root Mean Square (RMS) (valid range is 0.0005 - 0.0250 m); and
- v. % Observations Deleted (valid range is 0 - 25) %;

### 5.1 ARP to Ground Mark, per day

All heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP). The Antenna Offsets refer to the vertical distance from the ARP to the L1 phase centre.

Station	Height(m)	Antenna Offsets(m)			yyyy/mm/dd
	Up	East	North	Up	
test	0.0000	0.0000	0.0000	0.0000	2000/06/25

### 5.2 Apriori Coordinate Updates - Cartesian, per day

	dX(m)	dY(m)	dZ(m)	yyyy/mm/dd
test	0.146	-0.148	0.061	2000/06/25

### 5.3 Coordinate Precision - Cartesian, per day

1 Sigma	sX(m)	sY(m)	sZ(m)	yyyy/mm/dd
test	0.028	0.030	0.014	2000/06/25

### 5.4 RMS, Observations, Deletions per day

Data	RMS (m)	# Observations	% Obs. Deleted	Date
tow2	0.0038	1146	0 %	2000-06-25
alic	0.0038	962	0 %	2000-06-25
jab1	0.0054	1144	0 %	2000-06-25
test	0.0044	3252	0 %	2000-06-25

# A GPS Computation Standards

## A.1 Measurement Modelling

Observable	Ionosphere corrected L1 double difference carrier phase, Psuedo-range only used for receiver clock estimation, Elevation cut-off 15°, Sampling rate 30 seconds, Weighting 1.0cm for double difference, elevation dependent $1/\sin(E)$ .
Troposphere	Hopfield, Niell mapping function
Preprocessing	Receiver clocks estimated using pseudo-range information
Satellite center of mass correction	Block II x,y,z: 0.2794, 0.0000, 1.0259 m Block IIA x,y,z: 0.2794, 0.0000, 1.2053 m
Satellite Antenna Phase centre calibration	Not applied
Ground Antenna phase centre calibrations	Elevation-dependent phase centre corrections are applied according to the model IGS01, the NGS antenna calibrations are used when the antenna used is not a recognised IGS type. The corrections are given relative to the Dorne Margolin T antenna.
Atmospheric Drag	Jachhia Model
Centre of Mass Correction / Attitude	Nil

## A.2 Orbit Modelling

Earth's Gravitational (Static) Potential Model	EGM96 - degree and order 12
Solid Earth Tides (Dynamic) Potential	Love Model
Ocean Tide (Dynamic) Potential	Christodoulidis
Third Body Perturbations	Sun, Moon and Planets  Values for physical constants - AU, Moon/Earth mass ratio, GM(moon, sun and planets) from JPL DE403 Planetary Ephemeris.
Direct Solar Radiation Pressure	Rock

## A.3 Station Position Modelling and Reference Frame

Precession	IAU76/IERS96
Nutation	IAU80/IERS96 (including epsilon and psi corrections)
Sine terms added to accumulated precession and nutation in Right Ascension	As in IERS TN 21, p. 21
Geodesic Nutation	As in IERS TN 21, P. 37
Polar Motion	IGS Earth Orientation Parameters (Ultra-rapid, Rapid, Final) - apriori
Earth Rotation (UT1)	IGS Earth Orientation Parameters (Ultra-rapid, Rapid, Final) - apriori
Daily and Sub-daily tidal corrections to X, Y and UT1	Applied (IERS2000)
Plate Motion	IGS Cumulative SSC
Planetary and Lunar Ephemeris	JPL DE403
Station Displacement - Solid Earth Tide Loading	Williamson and Diamante (1972) + Wahr (1980) for the frequency dependent elastic response of the Earth's fluid interior.
Station Displacement - Ocean Tide Loading	not applied
Station Displacement - Pole Tide	applied
Station Displacement - Atmosphere Loading	not applied
Reference Frame	IGS Cumulative SSC