

## SPANISH-ARGENTINIAN GEODYNAMIC GPS NET ANTARTIC PROJECT

J. Ballesteros\*, M. Berrocaso\*\*, M. Catalan, F. Cruz\*  
 R. Estrada\*\*\*, A. Lujan\*, J. Muñoz\*\*\*, J. Sanchez del Toro\*\*\*  
 J.C. Sastre\*\*, R. Soto\*\* & J.G. Viramonte #

\* Instituto Geográfico de España

\*\* Real Observatorio de la Armada, San Fernando, Cadiz, España.

\*\*\* Servicio Geográfico del Ejercito, España.

# Universidad Nacional de Salta-CONICET- Instituto Antártico Argentino, Buenos Aires, 177 - 4400 Salta, Argentina.

### Resumen

Se presenta una red geodésica GPS antártica que une las Shetland del Sur, Península Antártica y el continente Sudamericano. Se prevee usar la red con medidas sistemáticas de alta precisión con fines geodinámicos para medida del movimiento relativo en tiempo real, del centro de expansión del Bransfield, Arco de Scotia etc.

**Key words:** GPS, Geodinámics, Antartica, Geodetic net, Spain, Argentina.

### Introduction

During 87-88; 88-89 and 89-90 antartic summer a Spanish-Argentinian geodetic-geodynamic antartic project built up and measured a high precision geodetic GPS net, that linked South Shetland Islands, Antartic Peninsula and South America.

The monuments, the geometry of the net and the hardware and software used as well as systematic future measurements will enable its usage for geodynamic purposes.

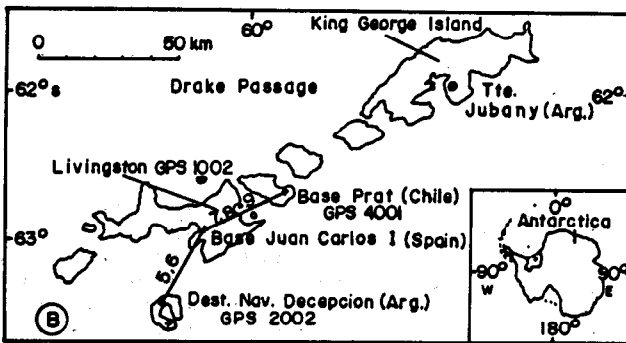
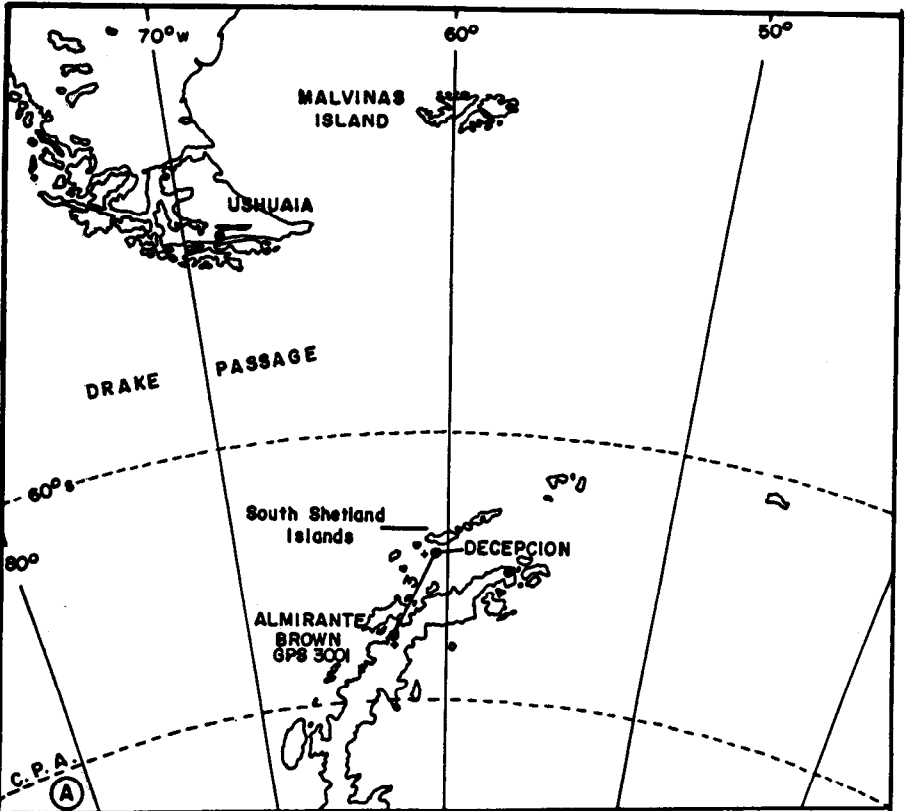
### The Antartic GPS net

Fig. 1 (A and B), shows the present Spanish-Argentinian GPS Antartic net at present and its future development.

Double frequency GPS 4000 SLD Trimble Navigation receivers and Trimvectm software were used. This fact has made it possible to reach good precision in absolute positionament (Table 1) and high precision in relative positionament between two station (Table 2).

Latitude, Longitude and ephemeris values are referred to the World Geodetic System (WGS-84).

During 87-88 southern summer GPS and Transit absolute measurements were made in 3 stations (Estrada 1989): 2 in



- REFERENCES**
- + GPS Station (3001)
  - Planned GPS Station
  - 6 Base Line

Fig. 1 Key maps show an Argentinian-Spain Antarctic GPS Net.

Livingston Island. (Punta Polaca and Base Antartica Española, Juan Carlos I) and 1 in Deception Island. (Destacamento Naval Decepción, Argentina); while in 88-89, four high precision GPS stations were built and measured (Ballesteros et al. 1989):

Livingston Island: Base Antártica Española (BAE-GPS 1002)

Deception Island: Fumarole Bay (GPS 2002)

Antartic Peninsula: Base Almirante Brown, Argentina (GPS 3001)

Greenwich Island: Base Arturo Pratt, Chile (GPS 4001)

During 89-90 summer we hope to link the Antartic GPS net with a point built in Ushuaia City, Argentina, South America and check the GPS Antartic net again.

We hope that future systematic measurements of the net, besides future Navstar constellation, hardware and software GPS system improvements will enable the net to be used for geodynamic purposes, specially for the control of the absolute movement in real time of the Bransfield rift spreading center.

#### References

Estrada Nérída R. 1989. Resumen de resultados de los trabajos topográfico-geodésicos realizados en la campaña antártica 1987-88. Servicio Geográfico del Ejército, España.

Ballesteros, J., Berrocaso, M., Catalan, M., Cruz, F., Estrada, R., Lujan, A., Muñoz, J., Sanchez del Toro, J., Sastre, J.C. Soto, R., y Viramonte, J.G. 1989 Las Campañas geodésicas 1987-88; 1988-89 en las Shetland del Sur. III Symposium de estudios Antárticos, Gredos, 3-5 Octubre 1989, Spain. Resúmenes.

TABLE 1

#### TRIDIMENSIONAL ABSOLUTE POSITIONING (GPS - 1988-89)

STATION	LAT.	LONG.	ALT.
1001-PUNTA POLACA (LIVINGSTON Is.)	62°39'43.37027" S	60°23'40.19608" W	33.410
1002-BAE (LIVINGSTON Is.)	62°39'46.95058" S	60°23'20.21120" W	30.668
2001-ARGENTINE St. (DECEPTION Is.)	62°58'30.33651" S	60°41'53.51385" W	20.037
2002-FUMAROLE BAY (DECEPTION Is.)	62°57'41.13540" S	60°42'59.70116" W	19.103
3001-AL. BROWN St. (PARAISO BAY)	No data		
4001-A. PRAT St. (GREENWICH Is.)	62°28'46.35638" S	59°39'47.63355" W	23.390

#### TRANSIT (WGS - 84) 1987-88

1002-BAE (LIVINGSTON Is.)	62°39'46.68" S	60°23'18.70" W	14.88
2001-ARGENTINE St. (DECEPTION Is.)	62°58'28.33" S	60°42'2.46" W	224.50

TABLE 2

## Base line 3: BAE-GPS 1002 to Al.Brown-GPS 3001

28 Jan-89	Lat	Long	Alt
Station 1	62° 39' 46.78564" S	60° 23' 20.50016" W	37.241
Station 2	Triple	Float	Fixed
Latitude	64° 53' 45.75426" S	64° 53' 45.76563" S	64° 53' 45.76539" S
Longitude	62° 52' 13.13249" W	62° 52' 13.08720" W	62° 52' 13.09208" W
Altitude	48.127	47.672	47.677

dx	-213721.495	-213721.198	-213721.251
dy	138298.894	138298.621	138298.584
dz	-109985.559	-109985.296	-109985.297
dh	10.886	10.431	10.436

Max. incr. FLT-FIX....5.3 cm

Recommended Sol. Triple.

## Base line 6: BAE GPS 1002 to Fumarole Bay GPS 2002

8 February -89

Station 1	62° 39' 46.79182" S	60° 23' 20.65322" W	42.062
Station 2			
Latitude	62° 57' 41.02229" S	62° 57' 41.02080" S	62° 57' 41.02090" S
Longitude	60° 42' 59.99319" W	60° 42' 39.99675" W	60° 42' 59.99704" S
Altitude	33.025 m	33.031 m	33.043 m

dx	-29094.644 m	-29094.667 m	-29094.669 m
dy	17552.562 m	17552.499 m	17552.495 m
dz	-15188.343 m	-15188.327 m	-15188.339 m
dh	-9.037 m	-9.031 m	-9.019 m

Max. Incr. FLT - FIX ... 1.2 cm

Recommended sol. ... TRIPLE

## Base Line 8: BAE GPS 1002 to Arturo Prat B. GPS 4001

20 February -89

Station 1	62° 39' 46.91018" S	60° 23' 20.43663" W	38.301
Station 2			
Latitude	62° 28' 46.28692" S	62° 28' 46.28876" S	62° 28' 46.28648" S
Longitude	59° 39' 47.87320" W	59° 39' 47.88655" S	59° 39' 47.89036" W
Altitude	29.444	29.471	29.481

dx	41389.059 m	41389.875 m	41389.857 m
dy	2919.514 m	2919.450 m	2919.373 m
dz	9429.326 m	9429.276 m	9429.295 m
dh	-8.857 m	-8.830 m	-8.820 m

Max. Incr. FLT - FIX ... 7.7 cm

Recommended sol. ... TRIPLE