



SOUTH AMERICAN GEOCENTRIC REFERENCE SYSTEM

SIRGAS

NEWSLETTER #2

December 1994



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EDITORIAL

I present to readers the second edition of the SIRGAS Project Newsletter. Since the issue of the first one, important progress was achieved towards the establishment of a geocentric reference system for South America. From this point of view, I emphasize the first meeting of the Working Group I "Reference System" and the second one of the Working Group II "Geocentric Datum", both held during the period 24 through 28 October 1995, in La Plata, Argentina. During the WG I meeting, the SIRGAS GPS campaign was scheduled for May 26 to June 04 1995, when about 51 stations, which will form the SIRGAS reference network, will observe the GPS satellites 24 hours per day. From this high precision frame, the WG II will integrate the GPS networks available in each country, using and encouraging the establishment of the necessary international ties. The classical networks integration, as the Resolution Nr. 2 of the first WG I meeting, will occur according to the interest of each country.

Besides the meetings mentioned above, it should be emphasized two other recent events where resolutions that specifically deal with and support the SIRGAS project were adopted: the XXX Meeting of the PAIGH Directing Council, through the Resolution Nr. VIII, and the XI Meeting of the Directors of South American, Spanish and Portuguese Geographic Institutes, through the Resolution Nr. 8.

The efforts that have been carried out by various groups and project collaborators, including the sponsoring entities (IAG, PAIGH and DMA), besides the steps that were already carried out by the Working Groups, have been generating a continually greater participation of various South American countries, establishing the necessary conditions for the achievement of the project objectives.

I would like to take this opportunity to wish to readers and families a new year with peace, happiness and success.

LUIZ PAULO SOUTO FORTES
President of Committee

COMPOSITION OF THE PROJECT

The composition of the Committee and Working Groups has changed in relation to one included in the first number of this newsletter, then the complete and updated version, including the electronic mail address, when available, is published below. The formation of the Scientific Council has not changed.



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INFORMATION ON WORKING GROUPS

WORKING GROUP I: REFERENCE SYSTEM (Information supplied by the President, Prof. Melvin Hoyer)

The first working meeting of the group was held during the period 24-28 October 1994, at the School of Astronomy and Geophysical Sciences of the University of La Plata, Argentina, simultaneously to the second Working Group II meeting and to the 18th Scientific Meeting of the Argentine Association of Geophysicists and Geodesists.

THEMES DISCUSSED AT THE 1st MEETING LA PLATA/ARGENTINA, OCTOBER 24 - 28, 1994

1. Evaluation of the activities carried out by the Working Group

The president of the Working Group, Dr. Melvin Hoyer, informed about the executed activities:

- Definitive conformation of the group;
- Working plan for 1994 and 1995;
- Communications sent to group and committee members;
- Received information about stations and instruments.

The IAG representative, Dr. Hermann Drewes, informed about:

- Pre-selection of stations according to received information;
- SIRGAS GPS observations in 1994 (17 stations in Brazil, Chile, Colombia, Ecuador, Guiana, Venezuela);
- Meetings in Europe with reference to the project;
- Existing SIRGAS data base at DGFI/I.

2. Selection and monumentation of stations to be observed in the 1995 campaign

The list of 47 pre-selected stations was revised and completed. It was agreed on to observing 51 stations during the campaign, which are presented in the corresponding annex along with the responsible institution for all phases of work referring to the station. This set of stations may be modified due to later analysis (*the list shown in the annex, with 52 stations, includes updates obtained after the La Plata meeting*).



The aspects related to the monumentation of principal and reference points were discussed, agreeing that the Working Group will send a circular with the corresponding specifications.

It was agreed that the representative of each country on the SIRGAS committee will send as soon as possible the following information to the Working Group:

- Station description including approximate coordinates;
- Complete name and address of participating institutions in the country.

3. Compatibility and availability of instruments

In accordance with discussion presented, the compatibility of the following instruments was accepted:

Ashtech Z12 Leica 200 Trimble SSE Turbo Rogue

with possible incorporation of any other type whose compatibility with the mentioned instruments has been proven.

The availability of instruments in each country was evaluated resulting in a provisional list of equipments to be used at each point, relying on offers from various collaborating institutions. The institution responsible for each station has to assure the availability of the corresponding instrument.

It was agreed to recommend to each country to assure the availability of one or more spare instruments in order to meet any eventuality. This or these instruments can be used for observation of eccentric stations while they are not required at a principal station.

4. Logistic details of the campaign

The date of the SIRGAS GPS campaign was fixed from May 26, 1995, 0^h UT to June 4, 1995, 24^h UT (10 days). The stations will measure simultaneously during a 24 hour period.

Other logistic and technical aspects related to the measurements were discussed. The Working Group will send the corresponding specifications to each country.



5. Data and processing centers

It was agreed to have a data center in each country, which will send the observation data to the global data centers. As global data centers, DGFI/I in Munich/Germany and IBGE in Rio de Janeiro/Brazil were designated. The contents of both data bases will be identical through continuous exchange of information.

The functions of the national data centers are the following:

- Collect the data of all stations of the country before June 30, 1995;
- Physically verify the diskettes, revise the field observation sheets, etc;
- Make at least one copy of the data and preserve it;
- Send the data by Internet or by mail to the global data centers as soon as possible and before July 30, 1995.

COUNTRY	COMMUNICATION	RESPONSIBLE INSTITUTION
Argentina	Internet	Observatorio de La Plata
Bolivia		(IGM Bolivia)
Brazil	Internet	IBGE
Chile		(IGM Chile)
Colombia		(Agustin Codazzi)
Ecuador		(IGM Ecuador)
Guyana		
French Guiana	Internet	IGN Paris
Paraguay		(DSGM)
Peru		(IGN Peru)
Suriname		
Trinidad & Tobago		
Uruguay	Internet	Universidad de la Republica
Venezuela		DCN

The institutions in parenthesis are subject to confirmation.

It is understood that the responsible institution for the observation at each station must send the data, **in RINEX format**, to the national data center in a way that this has the information available before June 30, 1995.

With respect to the data processing, the institutions DGFI/I (Germany), IfE (Hannover/Germany), DMA (USA), GSD (Canada) were requested to serve as principal centers of the project, recommending that each country participate in the data processing in accordance with its possibilities. In the same way, it was seen to be convenient to use different software in the computation in order to have independent controls.

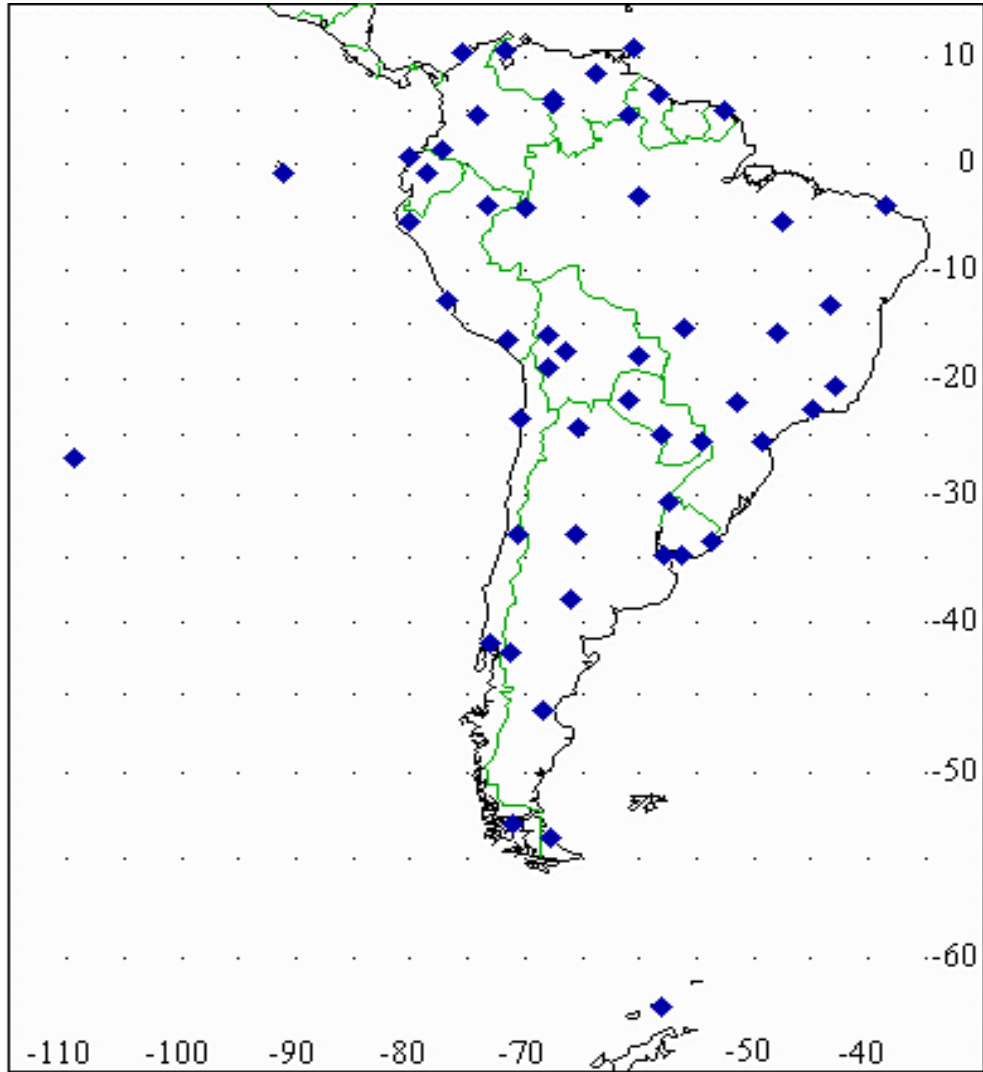


It was agreed that no person or institution is allowed to present or to publish partial or complete results of the SIRGAS network computations without previous authorization from the SIRGAS committee.



SIRGAS STATIONS (10.JAN.1995)

					INSTR.	INSTITUTION
ISLA REY JORGE	Antarctica	-62.3	-58.		(Z12/SSE)	IGM Chile
CHURCAL	Argentina	-24.31	-65.34			Univ. Tucuman
EL MAITEN	Argentina	-42.01	-71.21	Leica		Cat. Rio Negro
LA PLATA	Argentina	-34.91	-57.93	T. Rogue		Obs. La Plata/GFZ
LOTE 10B	Argentina	-46.04	-68.47		(SSE/Z12)	Cat. Chubut
LOTE 24	Argentina	-38.13	-66.09		SSE	UAGG Mendoza
MORRO	Argentina	-33.27	-65.48		Z12	UAGG Mendoza
PUERTO IGUAZU	Argentina	-25.60	-54.59			IGM Argentina
RIO GRANDE	Argentina	-53.79	-67.75	T. Rogue		Obs. La Plata/GFZ
AZANAQUES	Bolivia	-19.	-68.		SSE	IGM Bolivia
EL ALTO	Bolivia	-16.	-68.		SSE	IGM Bolivia
SURUTUVIA	Bolivia	-18.	-60.		SSE	IGM Bolivia
VILLA TUNARI	Bolivia	-17.5	-66.5		SSE	IGM Bolivia
BOM JESUS LAPA	Brazil	-13.25	-43.42		(SSE/Z12)	*
BRASÍLIA	Brazil	-15.95	-47.88	T. Rogue		IBGE / JPL
CACHOEIRA	Brazil	-22.69	-44.98		(SSE/Z12)	*
CUIABÁ	Brazil	-15.55	-56.07		(SSE/Z12)	*
CURITIBA	Brazil	-25.45	-49.23		(SSE/Z12)	*
FORTALEZA	Brazil	-03.88	-38.43	T. Rogue		IGS
IMPERATRIZ	Brazil	-05.50	-47.47		(SSE/Z12)	* - {IBGE/IFE/
MANAUS	Brazil	-03.12	-60.06		(SSE/Z12)	/UFPR/USP/
PRES. PRUDENTE	Brazil	-22.12	-51.41		(SSE/Z12)	/UNESP/UFV/
VIÇOSA	Brazil	-20.75	-42.90		(SSE/Z12)	UFPE}
ANTOFAGASTA	Chile	-23.5	-70.5	T. Rogue		IGM Chile /GFZ
ISLA DE PASCUA	Chile	-26.99	-109.38	T. Rogue		IGS
PUERTO MONTT	Chile	-41.5	-73.	T. Rogue		IGM Chile/GFZ
PUNTA ARENAS	Chile	-53.	-71.			IGM Chile
SANTIAGO	Chile	-33.15	-70.67	T. Rogue		IGS
BOGOTA	Colombia	+04.64	-74.08	T. Rogue		IGS
CARTAGENA	Colombia	+10.5	-75.5	Leica		Agustin Codazzi
LETICIA	Colombia	-04.1	-69.9	Leica		Agustin Codazzi
PASTO	Colombia	+01.2	-77.2	Leica		Agustin Codazzi
PTO. CARRENO	Colombia	+06.1	-67.5	Leica		Agustin Codazzi
GALAPAGOS	Ecuador	-01.	-91.	T. Rogue		IGS
LATACUNGA	Ecuador	-01.0	-78.6			IGM Ecuador
MUISNE	Ecuador	+00.6	-80.			IGM Ecuador
KOUROU	Fr. Guiana	+05.13	-52.62	T. Rogue		ESA / IGS
TIMEHRI	Guyana	+06.51	-58.26			Lands & Surv. Dept.
ASUNCIÓN	Paraguay	-25.	-58.			DSGM Paraguay
M ESTIGARRIBIA	Paraguay	-22.	-61.			DSGM Paraguay
AREQUIPA	Peru	-16.45	-71.48	T. Rogue		IGS
IGUITOS	Peru	-03.9	-73.3		(SSE)	* - {IGN Peru/
LIMA	Peru	-12.8	-76.8		(SSE)	/Univ. FA RFA}
PIURA	Peru	-05.3	-80.2		(SSE)	*
TOBAGO	Trinidad	+11.	-60.5			
CERRO VIGIA	Uruguay	-33.72	-53.58	Z12		{SGM Uruguay/.
MONTEVIDEO	Uruguay	-34.88	-56.27	Z12 + Leica		/Fac. Ing
YACARE	Uruguay	-30.60	-57.42	Z12		Univ. de la Rep.}
LA CANOA	Venezuela	+8.57	-63.85	Leica		{DCN/
MARACAIBO	Venezuela	+10.77	-71.67	Leica		/EIG/
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Stations of the SIRGAS Network



WORKING GROUP II: GEOCENTRIC DATUM (Information supplied by the President, Maj. Walter Subiza)

The second working meeting of the group was held during the period 24-28 October 1994, at the School of Astronomy and Geophysical Sciences of the University of La Plata, Argentina, simultaneously to the first Working Group I meeting and to the 18th Scientific Meeting of the Argentine Association of Geophysicists and Geodesists. That time, it was discussed, among other subjects, the status of the GPS information supplied to the Working Group by various South American countries, which is summarized below.

STATUS OF THE GPS INFORMATION SUPPLIED BY THE COUNTRIES

Argentina: has finished the development of the POSGAR project (ARgentine Geodetic POSitions) carried out from 1993 to 1994. A total of 130 stations, established on the principal triangulation network, is being adjusted by the University of La Plata;

Brazil: is in process of establishing 9 continuous tracking GPS stations (Brazilian Network for Continuous Monitoring of GPS - RBMC), which will be integrated into the SIRGAS Reference System; 75 GPS stations of the Basic Network were established from 1991 to 1994, from which 25 ones belong to the Classical Geodetic Network; due to the RBMC, it is not expected to increase the density of its GPS network; ties with the Venezuelan, Argentine and Uruguayan networks will be established during 1995;

Chile: has 185 GPS stations, established by geodynamic projects (CAP and SAGA), during 1993 and 1994. TRIMBLE 4000 SSE receivers were used. The stations cover the country from Arica, in the north, to Cabo de Hornos, in the south, including some in islands, with a bigger concentration in the center-north zone, due to a bigger seismic activity; the network is being simultaneously adjusted, in the United States (UNAVCO) and Germany (GFZ), expecting to be finished in April 1995. The number of stations to be integrated to SIRGAS Geocentric Datum was not defined yet, being planned to update the coordinates of the classical geodetic network to this Datum;

Colombia: is starting the establishment of a new basic network with GPS, and its end is foreseen for late 1995; owns 22 Leica receivers, dual frequency; now it has 49 GPS stations established, however its distribution is inadequate (along a tectonic fault line); it has 16 stations of the CASA project (1988 and 1991), which were re-observed in 1994 and 3 new ones were established (Total: 19 stations);



Ecuador: has 101 new GPS stations, established this year (1994) with TRIMBLE SSE receivers. The adjustment will be carried out by the University of Texas; 3 stations were established on horizontal classical network and 8 on the CASA network; it has a continuous GPS station in QUITO (DMA) and another will be set up at Santa Cruz Island (Galapagos) in 1994;

French Guiana: 2 stations (GPS and DORIS) which will take part in the SIRGAS Reference System;

Paraguay: has a new GPS network with 165 stations, observed from 1993 to 1994, with 39 established on the vertical control network. It will be adjusted and part of it integrated into the basic GPS network that will be established by this Working Group;

Trinidad and Tobago: 4 GPS stations were established with TRIMBLE 4000 SSE receivers, under an agreement with DMA;

Uruguay: does not have GPS stations yet, it will have 3 SIRGAS stations and more 5 ones in order to form its GPS basic network, which will be integrated with the GPS network to be established by this Working Group; it has 3 ASHTECH Z-12 and 5 Wild-Leica 200 receivers available; it is interested in adjusting its classical geodetic network integrating the GPS stations to be established; in cooperation with Argentina and Brazil, ties between their networks will be established;

Venezuela: established the SOUTH GPS Network, from 1992 to 1994, with TRIMBLE SST receivers, with 31 observed stations in total. This network was adjusted, and a standard deviation of 8 ppm was obtained. The data are available at Cartografia Nacional; Venezuela has 21 stations of the CASA'93 project, observed with Leica receivers. 5 stations of the CASA project were re-observed with TRIMBLE SST and SSE receivers in 1994. The CASA project data are processed by the DGFI (Germany) and are also available at Cartografia Nacional; the 4 GPS stations of the SIRGAS Reference System were established with TRIMBLE SST and SSE receivers in February 1994. The data are being processed by the DGFI; the number of GPS stations to be integrated into the GPS basic network, to be established by this working group, is 56; the Working Group has recommended the establishment of ties with Brazil (2, to be carried out in 1995). Besides, in order to have an adequate density of the network in Venezuela, the establishment of 4 new stations in center-south and center-west of the country was recommended.

The estimated total of GPS stations to be adjusted to the SIRGAS reference system is about 800.



Three levels of integration into the project, given by the following type of information, were theoretically determined:

ZERO ORDER OR MAXIMUM ORDER NETWORK:

- 50 GPS stations, approximately;
- established by the SIRGAS campaign in May/June 1995;
- Working Group I "Reference System" task;
- unclassified data;

CONTINENTAL 1st ORDER NETWORK:

- 800 stations, approximately;
- already existing, processed or to be processed GPS networks;
- executed, in execution or planned international GPS ties;
- Working Group II "Geocentric Datum" task;
- information to be requested as unclassified data;

NATIONAL 1st ORDER NETWORK:

- integration of the classical and/or topographic GPS networks;
- particular decision of each country based on its specific interest;
- specific solutions through exchanging ideas in each case;
- processing in the country itself, with technical assistance of the Working Group, if needed;
- classified geodetic data.

Data/processing centers for the Working Group: it was decided that each country could carry out the adjustment computations on its own; for this purpose, information related to all stations will be stored in a database to be established at IBGE, Brazil. In a first moment, IBGE itself and Uruguay, this last one throughout a joint project between Universidade da República — Serviço Geográfico Militar, have expressed their intention of carrying out the processing.

As it is mentioned in the Resolution Nr. 1 of this Working Group, the adjustment will be carried out using the vectors and covariance matrices, obtained from the processing executed by each country and available at the time of the adjustment.

International GPS ties: Brazil presented a report about the international GPS ties carried out in cooperation with Paraguay and Colombia, this last one as a direct result of the resolutions taken in April, in Bogota, Colombia. Besides, the tie between Brazil-Venezuela has been coordinated for 1995. During the La Plata meeting,



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representatives of Argentina, Brazil and Uruguay started the coordination towards tying their networks during 1995. As a result of the meeting, a first tie was carried out, on November 18, between stations of the future SIRGAS network, in Buenos Aires, Argentina (also a POSGAR station), and Montevideo, Uruguay (MONTEVIDEO station, ex-FORTALEZA). The observations have been exchanged, are being processed and it is expected to re-observe the ties including another SIRGAS station, in La Plata, Argentina.

Countries that have not sent information yet: **Bolivia** and **Peru**.

Countries with a representative (or correspondent) at the committee that have been contacted but have not responded yet: **Guyana** and **Suriname**.

With respect to the approved recommendations and resolutions, after discussions and exchange of ideas with the scientific consultants, it was decided in general to go ahead with the information and ties evaluation and to issue the following decisions and tasks.



WORKING GROUP II "GEOCENTRIC DATUM" SIRGAS PROJECT

Working Group II of the SIRGAS Project met in the University of La Plata, Argentina, in the frame of the 18th Scientific Meeting of the Argentine Association of Geophysicists and Geodesists, has made the following Recommendations and Resolutions:

RECOMMENDATIONS

1. Having learnt about the formation of a Geoid Sub-Commission for South America, supported by the International Geoid Commission (International Association of Geodesy), among whose primary objectives is: "To compute a global geoid model for South America with a resolution of 30' x30' using the available data";

Interpreting that the achievement of such objective will make possible that each country can develop, in accordance with its needs, its own detailed geoid model; and

Also knowing that, among the main applications of that geoidal information, is the correction of ellipsoidal heights, measured with satellite geodetic methods,

RECOMMENDS: that the South American countries collaborate in the tasks and activities of Geoid Sub-Commission for South America, releasing the information to make possible the development of a regional geoid model.

2. Given the progress made in the evaluation of existing satellite geodetic information, the new information received from the countries integrating into the SIRGAS Project, and the necessity of completing on time and correctly the evaluation, prior to the continental adjustment of the GPS network,

RECOMMENDS: that the South American countries continue integrating into the SIRGAS Project activities, to the best of their abilities, and releasing the geodetic information required for the mentioned evaluation.



RESOLUTIONS

1. Having analyzed the technical possibilities of the adjustment of the continental densification network, formed by the national GPS networks and the task of this Working Group, with a total of about 800 stations, RESOLVES:

That the mentioned adjustment will be carried out with the vectors and covariance matrices, obtained from the processing executed by each country and available at the time of the adjustment.

2. To reformulate the tasks and responsibilities of the Working Group, according to the annex detailed later, in order to continue the evaluation of the continental geodetic GPS information.
3. To establish as tentative date for the next meeting the first semester of 1995, in a place to be determined.
4. To thank the Argentine Association of Geophysicists and Geodesists, as well as the School of Astronomy and Geophysical Sciences of the University of La Plata, for having offered its hospitality and excellent organization in setting up this Meeting of the Working Group.

28 October 1994.

TASKS OF THE WORKING GROUP 28 OCTOBER 1994

Tasks	Coordinators	Tentative date
A. To continue evaluating the GPS data	Walter Subiza Muneendra Kumar	March 1995
B. Evaluation and Identification of international GPS ties	Hugo Bertola Walter Subiza	March 1995
C. Determination and evaluation of processing/data centers	Edvaldo Fonseca Jr. Don Beattie	March 1995
D. Next meeting	Walter Subiza Luiz Paulo Souto Fortes	(?) 1995