THE ASIA AND THE PACIFIC REGIONAL GEODETIC PROJECT

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Background:

The 13th meeting of the UN Regional Cartographic Conference for Asia and the Pacific, Beijing, May 1994, resolved to establish a Permanent Committee (PC) comprising of national surveying and mapping agencies to address the concept of establishing a common geographic information infrastructure for the region. The Executive Board of the Permanent Committee held its inaugural meeting Kuala Lumpur in May 1996; at which four technical working groups (WG) were established to address this problem, namely:

- WG 1:Geographical Information Infrastructure and Institutional Framework
- WG 2:Issues relating to Cadastral Infrastructure
- WG 3:Asia and the Pacific Regional Geodetic Networks
- WG 4:Legislation and Administrative Arrangements for the Acquisition and Sharing of Spatial Data

The second meeting of the Permanent Committee on GIS infrastructure for Asia and the Pacific was convened in Sydney on 30 September 1996. The plenary session of the meeting adopted three resolutions proposed by the Regional Geodetic Networks Working Group (GNWG). The role of the GNWG is "to establish and maintain a precise relationship between permanent geodetic observation sites across the region to provide a base on which to build a homogeneous Spatial Data Infrastructure (SDI) for Asia the Pacific Region". For the purpose of this project the definition of SDI includes products for geodynamics applications; meeting accuracy specifications for geodynamics are therefore implicit. Resolution 7(b) of the PC endorses the joint cooperative Asia and the Pacific Regional Geodetic Project (APRGP97) as a step towards the establishment of a regional geodetic infrastructure and the maintenance of a geodetic network for GIS applications. This was seen as a step towards a precise regional geodetic infrastructure which could be used for consolidating national geodetic datums and for integrating regional episodic geodynamics campaigns. It will also provide the basis of a regional framework of permanent geodetic observations which can be expanded as countries are able to add new sites.

This resolution was subsequently endorsed at the 14th UN Regional Cartographic Conference for Asia and the Pacific, held in Bangkok in February 1997. The project was also endorsed by the Asia Pacific Space Geodynamics Program (APSG) as providing an accurate reference frame for integrating scientific geodetic campaigns, and further supported by the regional VLBI network of the Asia Pacific Telescope (APT); at the Technical Workshop for APT and APSG 1996 (TWAA96) at Kashima in December 1996.

Observation Campaign:

During October 1997, the APRGP97 campaign will "simultaneously" observe at all GPS, SLR, VLBI, DORIS and PRARE permanent geodetic observing sites throughout the entire Asia Pacific Region; with the eventual aim of integrating the results of these techniques into a single homogeneous solution. Additionally, if opportune, Absolute Gravity measurements will be incorporated at significant sites.

Figures 1-5 shows the spatial distribution of the permanently observing sites for all techniques in the Asia Pacific Region. Only permanently observing sites will be used; augmented by some sites that

are of national interest to the host agency. Tables 1 and 2 shows the number of co-located sites and occupation by technique respectively. Australia will manage the overall project with close cooperation from China and Japan. Table 3 gives a comprehensive outline of the project; techniques, technique coordinators (responsible for data acquisition), and observation specifications.

Technique	GPS	SLR	DORIS	VLBI	PRARE
GPS	45	11	15	6	7
SLR	11	19	5	2	3
DORIS	14	5	25	2	4
VLBI	6	2	2	6	4
PRARE	7	3	4	4	8

Table 1. Number of collocated sites per observation technique.

The observed data will be assembled into a data base and made available to participating national agencies for independent processing and analysis. The distribution mechanism for each technique is demonstrated by figure 6, below. The data set for processing and analysis is open to participants from any all of the 55 national agencies in the United Nations Asia and the Pacific Region for their use. This will be made initially available through national agency representatives and subsequently will be available as a data set through the APSG. It is recommended that GPS site standards, as far as possible, conform to the IGS standards.

Terrestrial Connections:

Experience has shown that errors in the terrestrial connections between co-located high precision space geodetic techniques are a major source of error and concern when the results are compared or integrated. To this end accurate terrestrial geodetic ties between the ground antennae of the different techniques are vital. This will be the responsibility of each individual national survey agency to check the quality of the existing ties apriori.

Computation and Analysis of Results:

The independent results from each technique will be compared when analysed and combined solutions produced. Ideally this observational campaign would be repeated in the future as regional quality control and to maintain the precise geodetic reference frame within the region for use in spatial data integration. Initial processing for PRARE and DORIS will be undertaken by GFZ and CNES respectively. NASA/Goddard Space Flight Center have agreed to undertake initial correlation of VLBI data for up to six stations for the two twenty four hour observational periods. With the exception of the VLBI data, AUSLIG proposes to process all the other data types. The computation standards should conform to IERS Conventions (1996).

Presentation of Results:

It is proposed that the results are presented and compared in two stages:

- Independently computed technique specific results
- Combination / integration of the technique specific results for the final definition of the Asia Pacific Regional Geodetic Network The combination solutions my be undertaken by national agencies, IGS Global Network Associated Analysis Centres (GNAAC), IERS or other organisations that has the capability.

It is proposed that the initial GPS results be presented at the 4 th Permanent Committee meeting to be convened in February / March 1998 in Tehran, Republic of Iran. It is further proposed that the

independent technique specific (and any combination) results be presented at a workshop in mid-1998 in Canberra, Australia. The results will be published in a workshop proceedings.

Site	GPS	SLR	DORIS	VLBI	PRARE
KERG	■		■		
CHAT	■				
HOBA	■			■	■
WELL	■				
AUCK	■				
ORRO		■	■		
TIDB	■			■	
BATH	■				
SANT	■	■	■		
CEDU	■				
PERT	■				
YARA	■	■	■		
RAPA			■		
EISL	■		■		
ALIC	■				
NOUM			■		
KARR	■				
TOWN	■				
FIJI	■				
PAMA	■	■	■		■
AREQ	■	■	■		
WALL			■		
DARW	■				
COCO	■				
PMRB			■		
CIBI	■		■		
GALA	■		■		
COLO			■		
KWJL	■				
IISC	■				■
GUAM	■		■		
MANL			■		
SOCO			■		
HALE		■			
KOKE	■		■	■	■
SALR		■			
TAIW	■				
EVER			■		
LHAS	■				
WUHN	■				
SHAN	■	■		■	■
PURP			■		
SIMO		■			
GOLD	■		■		■
KASH	■	■		■	
USUD	■				
KOGA	■	■			
TOKY		■			
WING	■				
PLUME	■				
TAIJ	■				
KIT3	■		■		
BEIJ	■	■			
MAID		■			■
POL2	■				
URUM	■			■	
CHAN	■	■			
BALK		■			
KOMS		■			
BADA			■		
IRKT	■				
SARA		■			
MDVO	■	■			
KRAS			■		
FAIR	■		■	■	■

Table 2. Sites by Geodetic Technique.

Conclusions

The planned outcomes of the APRGP97 project are

- a high accuracy regional geodetic reference frame with all space geodetic fully integrated; consolidating all the national datums
- a basis for a homogeneous Spatial data Infrastructure – but having accuracies that can support any dense local and regional geodynamics campaigns along or across plate boundaries
- to establish dialogue, co-operation and mutual support for the recently formed space geodesy organisations in the region; APSG, WPLTN, APT and the Permanent Committee – which has to be carefully nurtured to produce maximum benefit to the region without duplication
- data quality assurance, in particular, SLR
- an examination of the terrestrial connections between the co-located techniques
- an assessment of the existing capabilities for space geodetic data processing and analysis [GPS, SLR, DORIS, PRARE, VLBI] in the region for appropriate expansion and/or improvement and to encourage national agencies to undertake space geodetic data processing.

References

Manning, J. (1996) *The Western Pacific and the APSG SLR Networks.* Proceedings of the Technical Workshop for APT and APSG 1996, TWAA96. pp26-32, Kashima December 1996

AUSLIG (1996) *Proceedings of Meeting of the Permanent Committee on GIS Infrastructure for Asia and the Pacific,* Sydney October 1996.

Table 3 APRGP97 OBSERVATION CAMPAIGN SPECIFICATIONS

Project Co-ordinator	**A**	**U**	**S** **Australia**	**L**	**I**	**G**
Technique	GPS (IGS)	GPS (NON-IGS)	SLR / no.passes	DORIS	PRARE	VLBI
Technique Co-ordinator	IGS	AUSLIG	WPLTN	CNES	GFZ	APT Shanghai Observatory
Satellites to be Observed	All GPS	All GPS	Lageos-1 / 20 Lageos-2 / 20 Ajisai / 30 Starlette / 25 Stella / 25 Etalon-1 / 20 Etalon-2 / 20	TOPEX Spot-2 Spot-3	ERS-2 Meteo-3	
Observation Period	7 days GPSWK 927	7 days GPSWK 927	30 days (Oct97)	30 days (Oct97)	30 days (Oct97)	2 X 24 hour campaigns 13 & 27 October 1997
# AP Sites	80 plus GPS	sites in total	19	25	8	6
Data Formats	RINEX	RINEX	CSTG/ MERIT-II #	DORIS standard *	PRARE standard	VLBIDBH @
Co-located Techniques						

Normal points. *Standard exchange format for range rate observations. @ VLBI Data Base Handler Format

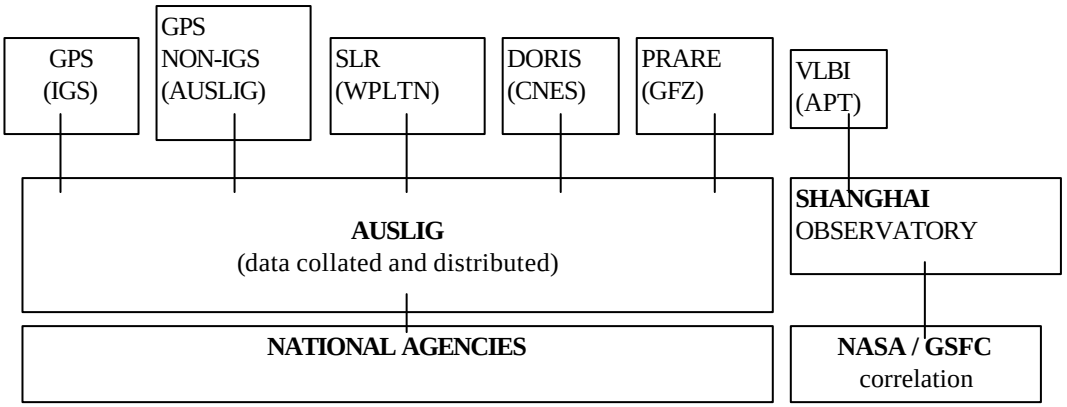

Figure 6 APRGP97 DATA DISTRIBUTION.