

**PHILIPPINES-AUSTRALIA LAND
ADMINISTRATION AND
MANAGEMENT PROJECT**

REPORT

on

SHORT TERM ASSIGNMENT

as INTERNATIONAL SURVEY ADVISER

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REPORT C57



**Land Administration & Management Project
Prototype Implementation Office I
Province of Leyte**

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1. INTRODUCTION

This report covers the activities of Andrew Dyson, International Survey Adviser during November 2004.

The activities of the International Survey Adviser were primarily directed at providing training for survey staff from the Department of Environment & Natural Resources (DENR) and the Land Administration & Management (LAMP) Project Implementation Office 1 (PIO1) in Global Positioning System (GPS) survey operations, data processing and adjustment. In addition assistance was provided to PIO1 survey staff in the development of plans for the extension of survey control into municipalities proposed for LAMP2 activities.

A copy of the adviser's terms of reference is included as Appendix 1.

2. TRAINING

The training was conducted from 3rd November to 19th November 2004. The training was essentially intended to equip the DENR Field Network Survey Parties (FNSP) of Region VIII with the capability to densify the Geodetic Network at the 3rd Order level throughout the Province of Leyte.

The objectives were to:

- Orient managers on the uses and processes for GPS;
- Provide essential competencies for field operators in the use of GPS equipment; and
- Provide competencies to data processors in the processing of GPS data to produce coordinates for approval in Region VIII.

There were three components to the training as follows:

- GPS for Managers – Workshop, 3rd November;
- GPS Field Operations – 4th to 8th November; and
- GPS Data Processing & Adjustment – 9th to 19th November.

2.1 GPS for Managers

The intention of this one day workshop was to provide an overview of GPS for DENR managers and the participants in the GPS Field Operations and GPS Data Processing & Adjustment components that was to follow.

The International Survey Control Adviser delivered a PowerPoint presentation informing participants on the GPS system, its application to surveying and broad guidelines on the appropriate techniques and procedures. The presentation was concluded with an overview of the procedures developed by LAMP PIO1 for densification of the network in support of project activities.

Eng. Oliver Ong, LAMP PIO1, demonstrated the Leica SR520 GPS receivers used by PIO1, followed by a short practical exercise wherein two receivers and antennas were setup outside and some satellite data was collected. The participants were then shown through the procedures for downloading of the data to a computer and the processing of the data.

2.2 GPS Field Operations

FNSP staff had selected a small project in Samar as a training exercise. Eight new 3rd Order control points were to be coordinated for the political boundary survey of Barangay Canabay, using Rapid Static techniques. Field work had been planned for 4th & 5th November but given the slow and difficult access to two points the observations had to be extended to include 8th November.

Ten persons participated in the field operations. All participants were provided with a copy of the *GPS Guidelines & Receiver Operation Manual*, developed by the adviser during 2002. They were also provided with their own GPS Field Sheets to complete during the observations.

2.3 GPS Data Processing & Adjustment

The data processing and adjustment training was seen as the most important component of the training with the objective of providing competencies to data processors in the processing of GPS data to enable them to produce coordinates for approval in Region VIII. From the outset the adviser indicated that he considered this objective to be unrealistic as in his experience this expertise could not be acquired over such a short time.

There were six participants, three from DENR's Regional Office, two from LAMP PIO1 and one from NAMRIA's Coast & Geodetic Surveys Department. The training was conducted from 9th -19th November, starting a day later than planned because of the need for an additional day of field observations. In addition there was the loss of one day for a public holiday, reducing the training to eight days.

There was further time lost because of delays caused by the lack of software licences and numerous power failures and brownouts.

Six computers were hired for the training but the project only had one licence to use the Leica SKI-Pro baseline processing software. The software was installed on all computers and many of the program features are accessible without the software key (dongle) but certain operations can only be executed when the dongle is attached to the computer. Accordingly, the participants had to wait for the dongle to become available and they were not able to work through some of the processes as they were being demonstrated.

Similarly, when it came to the adjustment phase of the training the number of licences available hampered the training. PIO1 provided two licences for the GeoLab software, NAMRIA provided one (originally purchased by the project in 2002) and the adviser provided his own licence. The adviser's licence was used for demonstrations and the participants had to share the other three licences. As the licence is digital, it was not feasible to keep swapping the licences backwards and forwards between computers and the participants had to copy their data files between computers to execute certain protected functions.

All participants were provided with a copy of the *GPS Processing & Adjustment Manual*, a comprehensive guide to using the SKI-Pro and GeoLab software (developed by the adviser during 2002) and copies of three reference guides provided with the Leica GPS system.

The first day was dedicated to some essential GPS and Geodesy theory and to the downloading of data from the GPS receivers.

The participants spent the next four days on the processing of GPS data from several observation campaigns, commencing with the data they had collected in Barangay Canabay. They were shown the various functions of the Leica SKI-Pro software and were given the opportunity to becoming familiar and competent in these processes. The emphasis was on the analysis of the baseline processing results and acquiring experience and confidence in recognising indicators of poor data. In this way it is possible to make an informed decision on selection of data for reprocessing. The achievement of a satisfactory result is usually an iterative process of analysis, data selection and reprocessing.

Data analysis was done as a group with each participant being given an opportunity and encouragement to contribute to the process and with less input from the adviser as they became more confident. The limited time available and the restrictions imposed by sharing one dongle did not permit the setting and execution of exercises to assess individual competencies.

From an assessment of the progress of the group, it was considered that a minimum of four days was essential on data processing before proceeding to the adjustment stage. There seemed little point in moving on without acquiring a reasonable level of ability and confidence in data processing and analysis. Unfortunately this left only three days to learn to use the GeoLab software and to deal with the complexities of executing and analysing adjustments. An unrealistic expectation.

No attempt was made in the limited time available to explain the theory of adjustments apart from the basic concept of a least squares adjustment. In the three days, the participants learnt the basic steps in the adjustment process, including converting the SKI-Pro baseline processing results into files suitable for adjustment. This included setting appropriate options for the adjustment and the required output format. Adjustments were carried out on the three data sets resulting from the three projects processed in SKI-Pro.

As much time as possible was spent on detailed analysis of the results of each adjustment run to determine the quality of the data and the need for further iterations. Participants were guided on the key indicators in assessing an adjustment. The analysis was again done as a group with all participants encouraged to contribute to the process. The limited time available precluded the setting of exercises to assess individual competencies.

Minimal time was devoted to the processes of extracting coordinates from adjustments and to the transformation of coordinates from WGS84 to PRS92 geographical coordinates and PTM grid coordinates.

There was insufficient time to address the issue of the integration of conventional traverse data into a GPS adjustment.

3. TRAINING EVALUATION

The adviser provided the six participants in the processing and adjustment training with an evaluation form at the end of the training, the questions were designed to provide an indication of the participants' perception of their ability to understand GPS principles, observation guidelines, undertake observations and specific tasks involved in the processing and adjustment of GPS data. A summary of the responses has been compiled and is attached as *Appendix 2*. The responses have been used to assist the adviser in making this evaluation.

In assessing the effectiveness of the training and the level of competency achieved, the following must be considered. Five of the six participants had to learn two new software

packages. In addition, at least one participant was not completely confident in using a computer and the Windows operating system.

One of the participants had attended the processing and adjustment training conducted in 2002, including four weeks of intensive on-the-job training in adjustments. She has also had considerable experience in the processing of GPS data for the FNSP, although using a different software package.

Another participant has had extensive GPS experience with NAMRIA dating back to 1989 and has experience with other processing and adjustment software packages.

3.1 GPS Principles & Observation Guidelines

With the exception of the two more experienced participants, the others have acquired a moderate understanding of the principles and observation guidelines from a short exposure to GPS training.

3.2 GPS Observations

On-the-job training has provided the opportunity for the participants to become familiar with the setup and operation of the Leica SR520 GPS receivers. They have developed some confidence in using the equipment on a small project in a realistic work environment, rather than on training exercises. The participants were exposed to a variety of situations involving both poor satellite visibility and poor satellite geometry. They have had to respond in the field, according to the situation at the time, to determine the appropriate length of observations necessary for a satisfactory solution.

It was noticed that there is a tendency to pay poor attention to important details in the field. In particular the GPS Field Sheets were not completed properly and little or no effort made to ensure that all entries were neat and legible.

Field pages provide a vital part of the record of observations. It is imperative that all relevant information is recorded in a legible manner for use by the person processing the data and as a permanent record of field activities. Party leaders must monitor standards and ensure that their staff comply with the requirements.

3.3 GPS Processing & Data Analysis

Four days were dedicated to data processing. One participant was clearly hampered by his limited experience in computer operations. This slowed his progress in the processing of GPS data.

Given the limited time available, most of the participants acquired a reasonable level of ability and confidence in data processing and analysis. An assessment of the level of competence of the individual participants and further training requirements is to be found in Table 1, Appendix 3.

Sustainable and effective training in GPS processing is a matter of long term experience (on-the-job training) under the guidance of a well experienced practitioner. Most of the participants need this type of training in a working environment before they are ready to proceed to independent processing of data. Only the two participants, who have had

previous experience, could be regarded as competent to undertake GPS processing and more importantly the analysis of the results without supervision.

3.4 Adjustment of GPS Data

The comments regarding effectiveness of training in GPS processing apply equally or more so to adjustment training. To be effective, there must be long term on-the-job training under the guidance of a well experienced practitioner.

The limited time available meant that it would be impossible to explore adjustments and the GeoLab software in any depth. In fact it was not possible to cover much more than the basic adjustment processes and some limited analysis of the results of simple adjustments. More complex adjustments and the integration of conventional survey data into a GPS adjustment were not addressed.

An assessment of the level of competence of the individual participants and further training requirements in relation to simple adjustments and analysis is to be found in Table 2, Appendix 3.

Two of the participants have gained a good understanding of adjusting GPS data with the GeoLab software and the analysis and assessment of the adjustment output to determine the suitability and quality of the data. Both have had previous experience and one has had formal training. This knowledge should be used as the foundation for further training and for long term on-the-job training. They need training in more complex adjustments and in the integration of conventional survey data into a GPS adjustment.

The other participants have gained a basic understanding of adjusting and analysing GPS data as the foundation for further formal and on-the-job training.

The participants lack knowledge on the theory of adjustments and would benefit from training in this area in support of further practical training.

4. OTHER ISSUES

A number of other issues have arisen during the course of the training and in discussions with the senior survey staff of PIO1. Attention was drawn to some of these matters in the adviser's reports of June 2002 and December 2002 and in many cases recommendations made, however there seems to have been little if any effort to address these issues.

It is recommended that PIO1's senior survey staff should revisit these reports and seek to address some of the issues and recommendations.

Issues raised during the adviser's current assignment include:

4.1 Manuals & Field Pages

As a result of the training some amendments and additions were made to the GPS Field Sheets and the two GPS manuals developed by the adviser in 2002. Copies of the updated manuals were provided for the participants and senior survey staff of PIO1 at the end of the training. The current versions of these manuals are:

- *GPS Guidelines & Receiver Operation Manual - version 1.4 (14 November 2004)*
- *GPS Processing & Adjustment Manual – version 1.9 (19 November 2004)*

Attention was drawn to poor practices in completing field pages in 3.2 above.

It is recommended that all PIO1 survey staff be issued with the new GPS Guidelines & Receiver Operation Manual before participating in the next GPS project.

It is further recommended that all GPS staff are reminded of the importance of recording all necessary information on the field pages in a neat and legible manner, and that party leaders monitor standards to ensure that their staff comply with the requirements.

4.2 Maintenance of Equipment

The internal batteries for the Leica SR520 GPS Receivers are no longer able to be properly charged and the external batteries are being relied on for power. It is essential that GPS receivers have a reliable alternative power supply connected at all times. It is a risky practice to rely on only one power source. Batteries are a consumable item and it is expected that they will need replacing from time to time when they reach the end of their reliable serviceable life.

It is recommended that the internal batteries on the Leica SR520 GPS receivers be replaced as a matter of urgency.

The hook provided for measuring the antenna height when the Leica AT502 antenna is mounted on a tripod contains a tape measure. The tape measures in both height hooks have been damaged, by either a lack of care in controlling the retraction speed of the tape or fair wear and tear. Accordingly they need replacing.

It is recommended that tape measures be replaced and that all operators are reminded of the care needed in using the height hook.

When the GPS equipment was purchased in 2002, the supplier failed to provide adequate tripod bags. Normal usage has resulted in holes developing in the bottom of the bags. It is important that tripods are given the appropriate level of protection in storage and transit to ensure that they give good service over a number of years.

It is recommended that the tripod bags are replaced with more suitable bags.

4.3 Geodetic Database

Issues relating to the long term sustainability of the CGSD Geodetic Database were raised during 2001. An extract of the advisers report of September 2001 follows:

“CGSD/NAMRIA maintains the Philippine Geodetic Data Base, known as the Geodetic Station Information System (GSIS). The data and records generated from densification of the geodetic network should be integrated into this data base and made available to the PIO, DENR in general and other possible users in the region.

The GSIS was developed during NRMDP in 1989 using Dbase software. As such its long term suitability to meet ongoing requirements should be investigated and if necessary the redevelopment or migration of the data base to a more modern system should be undertaken.

Some of the matters that should be addressed include:

- (i) CGSD/NAMRIA geodetic data base requirements;*

- (ii) *PIO and DENR geodetic data base requirements;*
- (iii) *Methods of sharing access to the geodetic data base and responsibilities;*
- (iv) *Hardware and software requirements.”*

The adviser was led to believe that CGSD was purchasing new software to update the database during 2002, but this appears not to have happened.

The adviser suggested that issues in relation to the upgrade and the project's requirements of updating the database from the regions as control is established, and accessibility to the database from the regions for all potential users should be addressed and recommended that:

The issue of accessibility to the CGSD Geodetic Database to update data and to obtain control information should be investigated and addressed.

In discussions with CGSD's representative during the training the issue of upgrading the database and its adequacy were discussed. In particular what would happen when a province has more than 999 control points. Lt Commander Ronald Gatchalian has since advised that the 999 point limit was exceeded in Leyte in 2003 and that the data for Leyte has been corrupted. This matter has serious implications for the project's geodetic activities now and in the future. It is anticipated that in future all provinces will have more than 999 control points.

It is recommended that urgent consideration be given to the migration of the CGSD Geodetic Database to a more suitable operating system (software & hardware). And that all issues related to the CGSD's requirements, LAMP requirements and the overall need of the Philippine surveying community be addressed.

4.4 Maintenance of Software

The issues of software upgrades and the installation of anti-virus software were raised in the 2002 reports.

No attempt has been made to provide ongoing support to ensure that the GPS processing and adjustment software packages are kept up to date by maintaining software upgrade agreements.

In addition, anti-virus software is neither installed nor maintained on project computers. As a result the GeoLab licences have been lost a number of times necessitating a special requests to the author and supplier to allow the project to reinstate its licences. When one of the GeoLab licences was being transferred to a DENR computer after completion of the recent training, the DENR computer was found to have had 2000 virus infections!

It is recommended that:

- ***Software upgrade agreements be maintained.***
- ***Anti-virus software be installed on all computers and kept up to date.***
- ***Funding should be provided for software upgrades and maintenance agreements.***

4.5 GPS Equipment

PIO1 has two GPS receivers, a configuration that is neither efficient nor effective in the long term, three receivers are required for any serious attempts at densification. If PIO1 is to be responsible for ongoing densification of the geodetic network there is an urgent need to purchase a third GPS receiver. In purchasing another receiver for PIO1 it is essential that it should be compatible with the two existing receivers, in other words it should be the same.

It is recommended that serious consideration be given to the purchase of another suitable GPS receiver for PIO1.

Appendix 1 Terms of Reference for International Survey Adviser

TERMS OF REFERENCE

INTERNATIONAL SURVEY ADVISER

2004 (1 month)

The PA-LAMP foreshadows a potential 15-20 year program to improve land administration in the Philippines. It is a strategic GOP initiative which aims to support an efficient land market and alleviate the present low level of confidence in the system of formal land registration and the lack of tenure security.

The **Goal** of AusAID assistance, through support of the TA program, is *to assist the GOP to improve the effectiveness, transparency and efficiency of land administration to achieve the resultant flow of economic and social benefits in the Philippines.*

The **Purpose** of the TA program is *to assist the GOP to establish structures and operating procedures for a long term program to reform the land administration system in the Philippines.*

The Survey adviser to the LAMP Project will be based in PIO1 (Leyte). He will report to the TA team leader through the deputy team leader and systematic registration adviser. The adviser will work closely with Project counterparts.

The approach at all times will provide the Project with best practice, a safe working situation and be Gender sensitive. The adviser will cooperate with the members of the Quality Assurance Panel whose job it is to verify that TA outputs are of a suitable standard and completeness. To this end, the adviser shall maintain an up to date work plan and have regular review meetings with counterparts on progress, issues and changes to the plan. A monthly report will be submitted to the team leader.

The overall purpose of this activity of PA LAMP is to strengthen the capacity of the region 8 to perform GPS surveys, and to also train selected DENR staff from other regions.

The International Survey adviser will be responsible for completing the following work by 30 November 2004:

1. Implement and assess a training program for PIO1 project survey staff on GPS surveys with emphasis on data processing and network adjustment.
2. Implement and assess a training program for DENR regional survey staff on GPS surveys including design of GPS surveys, data processing and network adjustment.
3. Prepare a brief exit report (max 3 pages with attachments as required) mentioning (i) the training accomplished, (ii) recommendations for future capacity building; (iii) an assessment of the competence of the participants.

End

Appendix 2 Training Evaluation – Summary of Participants’ Responses

GPS Observations, Processing & Adjustment Training

The table below provides a summary of the responses to the evaluation questionnaire, from the six participants who completed the processing and adjustment training.

In the capability column, the numbers indicate how many participants perceive that they have reached the particular level. All comments have been included.

Task	Capability	Comments
Understand the Principles of GPS:	High 2 Medium 4 Low	
Understand the GPS Observation Guidelines:	High 3 Medium 3 Low	
Undertake GPS Observations using the Leica SR520 Receivers:	High 4 Medium 2 Low	
Undertake GPS Processing using Leica SKI Pro software:	High 3 Medium 3 Low	
Analyse unsatisfactory baseline processing results and determine a strategy for reprocessing:	High 2 Medium 4 Low	

Task	Capability	Comments
Undertake simple GPS adjustments:	High 2 Medium 4 Low	
Assess the quality of GPS observations in an adjustment:	High 3 Medium 3 Low	
Remove outlier observations from an adjustment:	High 3 Medium 3 Low	
Transform coordinates and produce coordinate listings from an adjustment:	High 3 Medium 3 Low	
Effectively deal with GeoLab files:	High 2 Medium 4 Low	
Troubleshooting:	High 1 Medium 2 Low 3	

Do you feel that the training has been adequate to meet your ongoing needs?

1. Yes, (5 responses)
2. No due to time constraint.

Any other comments?

1. Training needs more time, specifically on analysing.
2. Longer sessions may be needed for newcomers..
3. Computer literacy should be a pre-requisite.
4. The program should have been explained fully to DENR management in order to allow us to attend this training for a longer duration.
5. I need more time to practice in the operation of the computer.

Appendix 3 Training Evaluation & Future Training Needs

Table 1
GPS Baseline Processing using Leica SKI-Pro

Name	Operation of Processing Software		Analysis of Processing Results	
	Level	Training Need	Level	Training Need
Ray Banez	Medium	On-the-job	Medium	On-the-job
Norman Ibanez	Low	Basic computer operations. Formal & On-the-job processing.	Low	Formal & On-the-job.
Dioleta Villas	High	None	High	None
Mary Ann Galon	Medium	On-the-job	Medium	On-the-job.
Clint Balo	Medium	On-the-job	Medium	On-the-job.
Ronald Gatchalian	High	None	High	None

Table 2
Simple GPS Adjustments using GeoLab

Name	Operation of Adjustment Software		Analysis of Adjustment Results	
	Level	Training Need	Level	Training Need
Ray Banez	Low - medium	Formal & on-the-job	Low	Formal & on-the-job
Norman Ibanez	Low	Formal & on-the-job.	Low	Formal & on-the-job
Dioleta Villas	High	On-the-job	Medium	On-the-job
Mary Ann Galon	Low – medium	Formal & on-the-job.	Low	Formal & on-the-job.
Clint Balo	Low - medium	Formal & on-the-job.	Low	Formal & on-the-job.
Ronald Gatchalian	High	On-the-job	Medium	On-the-job