VERY LARGE BLOCK AERIAL TRIANGULATION (VLBA) - II

José Bittencourt de Andrade
François Albert Rosier
Mary A.A. Olivas.
Paraná Federal University
Brazil
Comission III/2

Abstract.
The aim of this paper is to show the feasibility of VLBA as conceived by ANDRADE (1983) in VLBA - I. The VLBA concept permits to elevate the capacity of a system (computer +program) to the second power, e.g. if the capability of a system is to solve 100 unknowns, with the VLBA concept the theoretical limit will be 10000 unknowns. The way to perform such a convenient goal is by combining the bundle and independent model methods.

Introduction.

In spite of the developments occurred during the last two decades, aerial triangulation did not reach yet its potential limits. There is much to do in the field of modeling. But the Photogrammetric Companies are looking for best performance in terms of number of photos versus number of ground control.

It was shown (ANDRADE(1983a)), that ground control serves only to realize a desired (defined or not) system of reference. The consequence is that a large amount of ground control does not improve the internal precision of an aerial triangulation. Consequently, the number and distribution of ground control must be such that a very good realization of the desired system of coordinates results. Of course, the best geometry will be that of points located in areas as far as possible (like in the corners of the block) and independently determined, to allow the abandon of wrong points without looses for the strenght of the geometry.

The concept of VLBA (ANDRADE(1983))

In view of the above, it is clear that the size of the block plays the most important role from the economic point of view. The concept of VLBA is $VLBA=(LBA)^2$, where LBA means the number of unknowns to be solved in a Large Block Aerial Triangulation. This goal can be reached by combining computer programs written for bundle block and independent models, as follows:

By the bundle method, one can solve sub-blocks (or super-models) in an arbitrary system of coordinates realized in a minimum constraint solution. In addition to the perspective centers common to neighbour sub-blocks, there are also overlapped areas, as shows the figure 1.

Some common points for the different sub-blocks can be thought as points of an independent super-model. Then a program for independent model may transform all the super-models points to an unique geodetic frame. Now every sub-block has enough control to allow the transformation of all their coordinates from the arbitrary frame to a geodetic system of coordinates. The figure 1 intends to give the graphical idea of the method.

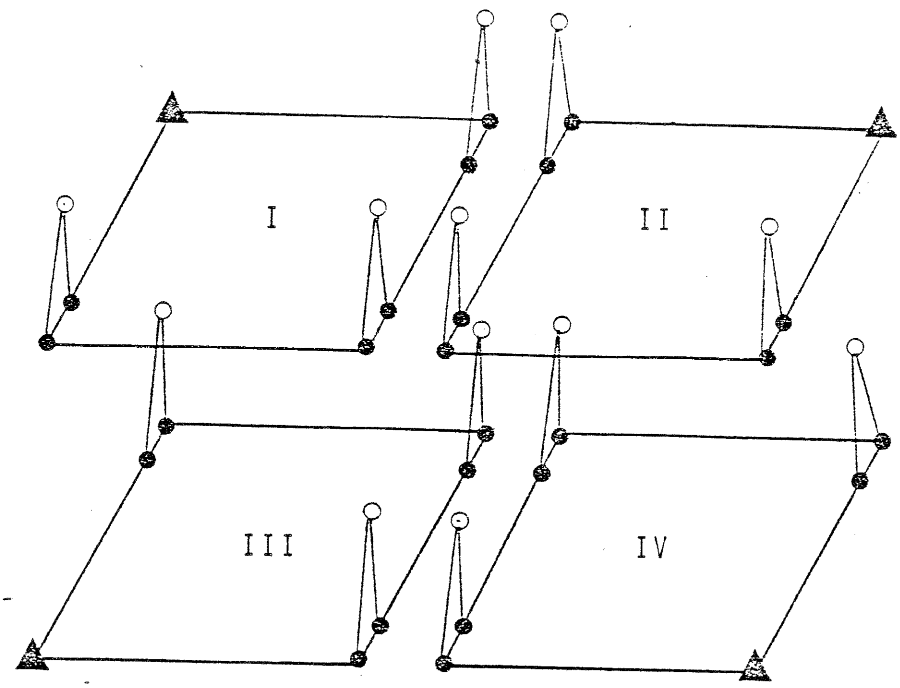

Figure 1. The Geometry of VLBA

A strong geometry is guaranteed by overlapping all the super models.

The experiment.

To verify the feasibility of the VLBA concept an experiment was performed using simulated data. A block of 35 photos at the scale 1:10000 distributed in 5 strips of 7 photos each was simulated. The photo-coordinates were generated with a noise of 5 micrometers (standard deviation). The block was divided into four sub-blocks as figure 1 shows.

Using a program for bundle block method each block was adjusted into an arbitrary frame defined by 7 parameters (origin, attitude and scale). Only some common points among the sub-blocks (or super-models) were kept. A program written by ROSIER (1983) for independent models adjusted the super-models into a geodetic reference frame realized with all the control points in the area (4 points located at the corners of the block). The results of this process were the necessary elements to realize the geodetic frame for all the sub-blocks. Now every sub-block was processed again to give the final results.

The results

It was observed in the first processing (to form the super-models) that the geometry can be tremendously improved if the pass-points are not taken close to a straight line.

The final error (|computed value - simulated value|) of the coordinates was in average 0.19 meters. Surely it can be improved mainly providing best geometry. The system is very flexible and permits studies to optimize the geometry.

Table 1 gives a résumé of the results:

SUB-BLOCK	ABSOLUTE ERRORS (UNIT: 1 METER)								
	MEAN			MINIMUM			MAXIMUM		
	X	Y	Z	X	Y	Z	X	Y	Z
I	0.190	0.208	0.364	0.005	0.012	0.002	0.475	0.527	0.988
II	0.131	0.119	0.276	0.006	0.005	0.000	0.303	0.249	0.830
III	0.106	0.139	0.288	0.005	0.007	0.001	0.335	0.305	0.973
IV	0.076	0.103	0.253	0.000	0.001	0.000	0.299	0.312	0.781

Table 1. Average of the absolute errors.

The method is feasible.

Next, the research group will look for best geometry, for a full scale experiment, for real data and finally for the optimization of the programs to allow easy use of it.

References

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