

Aerial Mapping Large Areas Replacing Extensive Measurements and Research of Field

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Abstract— The project presented here brings results of images and the registration of producers in the municipality of Balsas in Maranhão, home to large grain explorers since from the field visits we can highlight that the predominant crops are soy, maize, sorghum and cotton in order of production, the municipality of Balsas stands out for mechanized agriculture For the 1 000 km² service of air mapping in the municipality of Balsas was divided into 10 zones of 100 km² and each area of 4 subplots of subdivide 25 km² was divided so that there was a better combination for the images the main objective was to perform an aerial mapping in order to generate orthophotos that evaluate the conditions of land use in the municipality, together with field interviews for the verification of rural producers' licenses, in order to create a database in order to subsidize future civil works and determine the current land use. From the preliminary results were registered 27 large producers of these 18 already had or have some type of environmental licensing all issued through the State Department of Environment. The aerial mapping yielded a single georeferenced orthophoto GSD 15 cm where it is possible to analyze many parameters of land use.

Keywords— Mapping, Drone, Land Use, Maranhão

I. INTRODUCTION

According to the work of MOTA & PESSOA (2009) the Southern Maranhense Meso-region and, in particular, the Microregion dos Gerais of Balsas where the city of Balsas / MA is located, was inserted in this "modernizing" process. From the 1970s onwards, the micro-region saw the arrival, with greater intensity, of agriculturalists from the southern center of the country, particularly the Southerners, who settled in this region to spread agriculture linked to grain production. It is important to

emphasize that the low price of land, together with the flat topography of the region, are understood as fundamental in this process, however, they are not the only elements that have made the South of the State of Maranhão emerge as an economic frontier. Nevertheless, they are the main elements that account for the causes of the migration of farmers from the Center-South toward this locality. In relation to the relief of the region, there is a flat topography favorable to the use of agricultural machines. The basic idea of this relief profile is to demonstrate that the physiographic aspects played an important role in the installation of mechanized agriculture in the region.

Balsas is a town typically made up of people of all ethnicities, covering a large number of Northeastern and Southerners who discovered a great place to work with agriculture. Balsas, has a large agricultural area that contains fertile land where it is widely known throughout Brazil for its management, use of state-of-the-art agricultural technologies and work in soybean, rice, corn and cotton crops, as well as fruit growing. The city has asphalted exits to all the capitals of Brazil, as well as a small airport and also the Railroad distant 225 km, which connects the Agricultural Pole to the Port of Madeira in São Luis - MA. Soybean production in Maranhão is almost destined to the external market of 85% and 15% for the domestic market which is a large part of the world's largest economy, CASTRO & CASTRO (2005). How to solve this problem is more and more common use of RPAS (Remotely Piloted Air) or VANT's (Vehicles Aircraft) for the mapping of the surface in both civil and military spheres. Because the background levels are resolutions of a few centimeters and accuracies compatible with photogrammetric conventional aerial surveys or LIDAR (Ferreira A.M.R., 2014).

The VANTs can be used for various applications such as archaeological documentation, precision agriculture, property registration, security and other applications (Eisenbeiss 2009).

The result is: orthophoto and a digital elevation model. With orthophoto generated from the processing of VANT images, it is possible to apply geographic information extraction techniques. The extraction of geographic information can be carried out using traditional techniques of automatic extraction of information based on digital classifiers or manual vectorization (Santos, Freire et al., 2010).

Przybilla and Wester-Ebbinghaus (1979) did the first experiments with VANT in photogrammetry. They flew in the 1: 1000 scale, shutter speed of the camera. order of 1/1000 s, with aircraft speed sufficient to obtain acceptable images even on the move. Zischinsky et al. (2000) used images obtained with a model of the type helicopter to get the 3D model in Studies of agriculture, have begun to interest early by (ALBERS, NYQUIST, PURDY, 1996; SNYDER et al., 1999; JOHNSON et al. 2001). In particular, there are at present several challenges and prospects and for agriculture highlighting the monitoring of resources natural, environment, atmosphere, imaging hyperspectral, observations of rivers and lakes, and such as the imaging of agricultural practices and (JORGE et al., 1999; JORGE, 2003; EISENBEISS, 2004). Herwitz et al. (2004) carried out a mapping of 1500 ha of coffee plantations in Hawaii, obtaining images of multispectral high-resolution by VANTs.

II. OBJECTIVE

Perform aerial survey with the use of VANTs in the municipality of Balsas state of Maranhão aiming the mapping of large areas replacing extensive measurements and field surveys, thus compose an inventory with the relation of the owners or responsible for the exploration of the land.

III. MATERIALS AND METHODS

The municipality of Balsas is in the southern state of Maranhão is about 815 km from the capital São Luiz, and has a climate according to the classification of Koppen, is defined as AW With a precipitation around 1,232 mm a year.

For the location of the study area was divided into 10 zones of 100 km² the rural area where the main agricultural activities stand out. Each zone contained 4 subplots of subdivide 25 km² so that there was better combination to compose the mosaic of images. The municipality in question presented some particularities as access, resistance of the owners and mobility. Thus, a reorganization was made in accordance with the

permissions of the owners, as mentioned there was a lot of rejection, so some areas were started and when the permissions were made the remaining areas were raised and with that some areas have a different aspect in some cases since there was cleaning or use of the area in the transitional period to return to sub area. The SEMA of the municipality can not cooperate since it did not have the information of Environmental Cadastre and Rural Licensing, until the closing of this report there was no return with the rural union, since these are restricted only to foundations and companies of its personal character, there was the demand to map large rural extensions in a safe manner to the staff. Figure 01 below shows how the total mapping area was chosen and figure 02 shows the subdivision of the areas into 1 000 km².

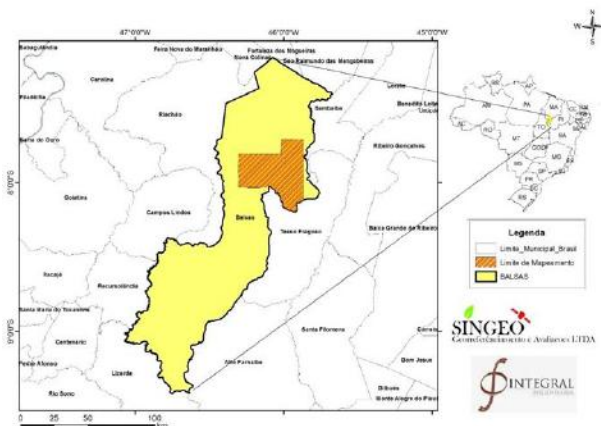


Fig. 1: Location Map of Desktop

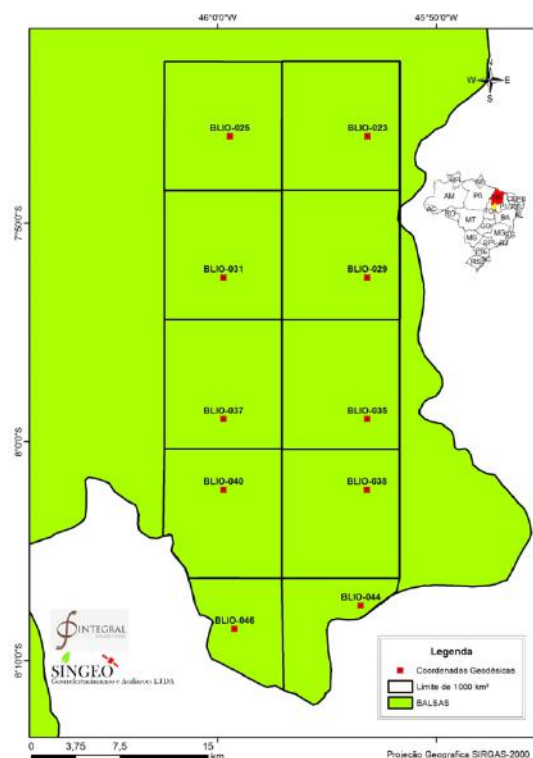


Fig. 2: Work Zones.

The choice of the subdivisions of the work areas was done in an automated way with the help of ArcGIS 10.1 software.

The flight plans were made according to the accesses and topography of the zones where in each zone center a geodesic coordinate was generated and the visualization points were generated according to figure 3 below. The flights were programmed according to the time of each battery about (25 min / 300 ha) created in the dronedeploy (dronedeploy.com) application that managed the productivity of this work, which generated a daily average of 1000 ha / day in days of "good" weather without rain, the control point reports are in the table below. Later the zones were combined in the software agisoft photoscan and mosaicados in its due group (zone), forming only one file rectified and adjusted. The telemetry was very successful since in ideal topographic conditions it was efficient.

IV. PRODUCERS REGISTRATION

To carry out the registration of the producers, interviews were initially made with the Rural Union of the Municipality "SindiBalsas", the end Environment Secretariat of the Municipality "SEMMA" and the State Secretariat of the Environment "SEMA-MA" to obtain information about the land register and contacts of rural producers. SEMAS does not have a register or information about Rural Environmental Registration (CAR) or Environmental Licensing (LAR) of rural properties. The state does not pass information and there is no possibility of downloading them online since the SICAR System of Maranhão does not allow consultation by: name, CPF or property.

Thus the Work had to visit the properties and environments of the work area, many properties that plant big grains are family complexes and the same are not welcoming in the work since the reluctance about the objectives this study, questions about the main motivation, and if they are going to have benefits, this in a way causes discomfort in getting the job done.

V. RESULTS AND CONCLUSIONS

The families of producers are of southern majorities and have a very restricted cultural form which in some situations did not allow the mapping in more detail. We have been able to obtain information about each Georeferenciada Rural Property and the Official Gazette of the Federal Government (INCRA) with information about the properties they have, or have had environmental permits, and together with some producers who have provided information on the property. A spreadsheet with name, situation of CAR and LAR name of the property, Certification via INCRA and other information such as CPF or contact was made.

The results of the aerial survey allowed to reach the objective of this study, in each zone of 100 km² generated about 850 photos with average altitude of 120 meters obeying the current legislation on operations with drone, for the composition of the mosaic of each zone it was necessary to use a computer core i7 with 4 gigabytes of video card and ram of 16 gigabytes where it took about 8 hours of processing in high quality, the routine was as follows (1) alignment and insertion of control points (2) Adjustments and calibration of (3) Creation of points cloud (4) Development of Digital Elevation Model figure 3 (5) Extraction of contour lines (6) Ortortification.

With 10 zones of 100 km² all processed, the mosaic was done with the help of the ArcGIS 10.3 program and the generation of a single spatial resolution product "GSD" 15 cm with size of 180 gigabytes in tiff format, the figure 4 below presents the result of this mosaic.

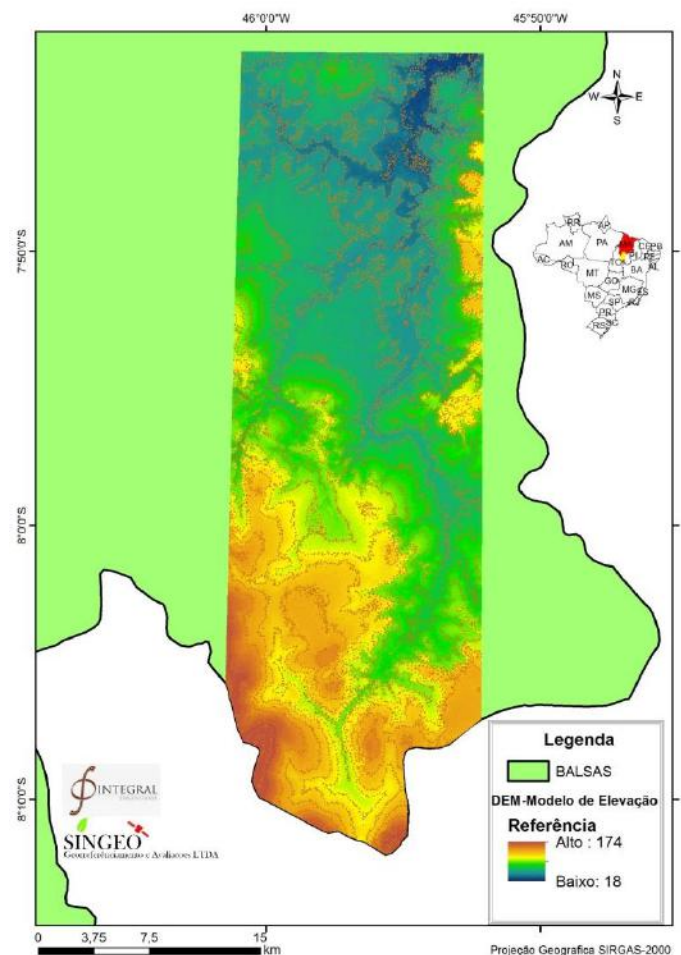


Fig. 3: Map of Altimetry of the Desktop.

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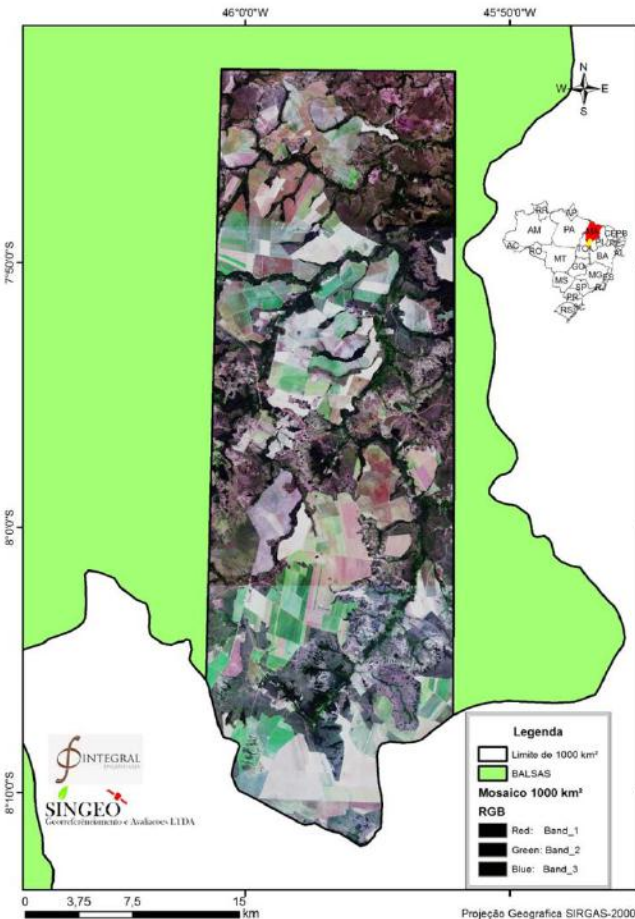


Fig. 4. Adaptive orthophoto of the Work area.

VI CONCLUSION

From this preliminary results were registered 27 large producers of these 18 already had or have some type of environmental licensing all issued via the state SEMA. Everyone already has CAR, there are large tracts of land that have not been registered for reasons of not having owners, headquarters or something that can prove the use of the soil. The products were organized in folders and sub-folders recorded on media, containing level and drainage curves in dwg (CAD) and shp (GIS) format, Ortofoto Mosaico Integral of the area of 1 000 km² in TIFF format, Elevation model in TIFF format, flight recording and simulation models, xls worksheet with information of the owners of this area (1000 km²), obj and LAS 3D models. The aerial mapping allowed to obtain a unique georeferenced orthophotometer with GSD of 15 cm where it is possible to analyze several parameters of land use.

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