

A Practice in Producing Digital Bird's-eye-view Urban Photomap

Jianwei Qi

Hebei Digital Photomap Co. Ltd.
287, Donggang East Road, Shijiazhuang,
Hebei, China
Email: hbsm@china.com
<http://qijianwei.friendpages.com>

Xianli Zhang

Hebei Bureau of Surveying and
Mapping,
495, Zhongshan East Road,
Shijiazhuang, Hebei, China
Email: hbsm@public.sj.he.cn

Abstract: different from the orthophoto map produced with the conventional aerophotogrammetry, Bird's-eye-map can reflect the actuality of the urban area with very strong stereo effect and artistic value. A totally new method to produce Bird's-eye-map with tilt digital aerophotogrammetry was developed by the author, this method has been tested in the producing of Urban map of Baoding and proved to be successful. The whole process regarding this new technology was introduced in this paper from tilt digital aerophotography, digital image rectifying till the final map printing as well as some experience from the author.

Key Words: Digital Photomap

With the features of intuitionistic, three-dimensional and widely negotiable, photomap is more suitable for persons who have no professional knowledge to refer to compared with line drawing map. In urban planning and construction, photomap will enjoy a prospect future due to its advantages that normal map can't substitute, such as reflecting the real characteristics of a city and skimming over a city at a glance. Nowadays, photomap has not been utilized widely in our daily life due to high costs and long cycle of production. The flow chart of photomaps producing are shown as chart 1 which includes the working procedure of aerial photograph, photograph development, negative film scan, photograph rectification, and image manipulation etc.. It would need about one year to accomplish a photomap for one capital city of a Chinese province. Scanning is the relative trivial task among those working procedures since almost hundreds to thousands of negative films need to be scanned for the one city. Are there possibilities for us to capture the digital image information through digital video camera directly and then put these information into computer? After times of experiments, we got it at last. Meanwhile we improved the traditional methods of producing photomap by adjusting the aerial photographic camera's angle from vertical to oblique so that there would be a better overlooking and visual effect. The working flow chart we adopted is showed as chart 2.

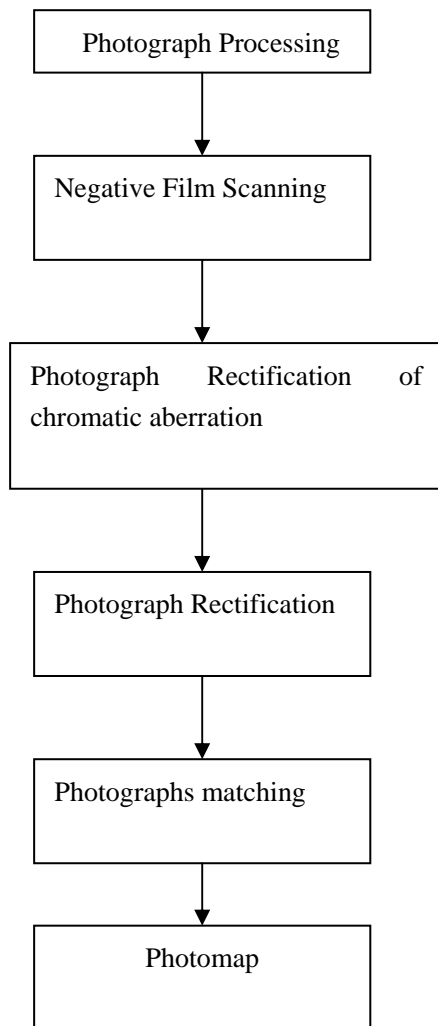


Chart 1

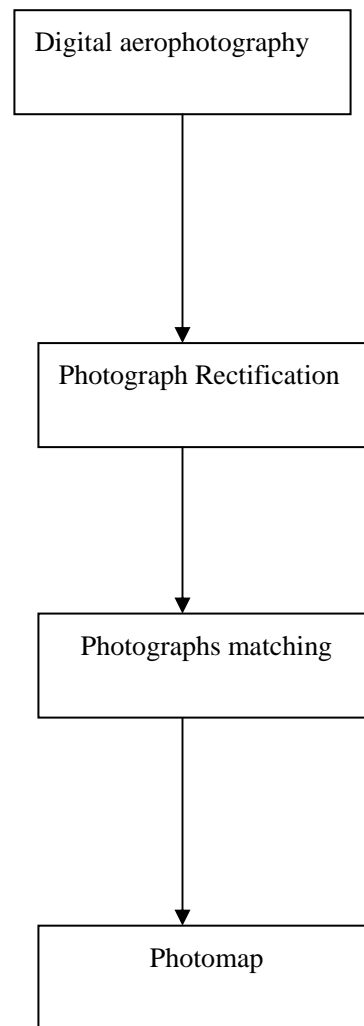


Chart 2

1. Aerophotography Methods

We adopted a helicopter as our aircraft in this aerial photographic experiment on which two positioning types of GPS receivers were equipped. Corresponding to the receivers on the helicopter, two sets of GPS receivers were fixed on the ground. Through GPS positioning technology, the locations of the helicopter could be determined at any time during flying. The data of location could be utilized in the image manipulation later. Besides, a GPS navigator was equipped on the helicopter. The helicopter would fly following a preset flight strip.

To capture the ground data digitally, we adopted a modified digital camera instead of the traditional optical aerial photographic camera. Times of experiments approved that the storing capacity was far from satisfaction by using the digital camera only. One main problem is the 10 seconds storing time for each map make the photographing not possible to catch up with the flying. To resolve this problem, we linked the digital camera with a notebook PC on which a special software we developed was installed. By matching the photographs what were input from the

digital camera to the notebook PC, the photograph was not a single photo any more, but a strip of photos. The theory is quite similar with the theory of scanner, just like an air scanner scanning the ground. The flying height and the focal length should be decided according to the photographic scale. What we adopted were 600 m flying height, 120 sq photographing area, 12 flight strips. To make an overlooking map, the camera lens should be adjusted from vertical to sustained 12 degrees oblique to north so that the visual angle of photographed objects could be unified relatively. Due to the application of GPS navigator, the four hours flying were very successful. What we got were digital data. After photographing, we could immediately check the overlap degree of flight strips.

2. Image processing

After photographing, the data were download from notebook PC to graphic working station to be processed. The First step is photograph rectification with the similar method with the traditional one except for the tilt rectification, it will not be described here. After photo rectification, through the processes of seamless matching, colorific saturation and aberration processing, there comes the digital photomap. chart 3 shows half of the final map and chart 4 shows the enlarged one. chart 4 shows that all the building have a almost the same obliquity which enhanced the three-dimension visual effects considerably compared with the normal photomap.



© 2000 株式会社 国土院

Chart 3 the final map (1/2)



Chart 4 enlarged map



Chart 5 suggested improvement

**Economic Comparison between this method and traditional one
Comparison taking Baoding photomap as an example:**

Working procedure	Workload with the new method(day/man)	Workload with the traditional method(day/man)
Aerophotographing	1×5	1×6
Photo Processing	0	2×10
Negative film Scanning	0	2×30
Chromatic aberration	1×10	2×30
Photo Rectification	2×20	2×30
Photo matching	2×10	2×20
Total amount:	75	246

With the traditional method, 200 photos are needed . Also we have to go through some unskillful methods like scanning and processing the negative film nicks. While with the digital photographing methods, only 12 strip photos are needed. It is much easier in the respect of image processing and the workload is only one third of the traditional one.

3. Experiments obtained

- a) The color, aberration, and image quality of the image captured with digital photography are much better than that captured with the optical photography, also it much easier to produce bird's-eye photomap. Furthermore it can save about one third time in the map processing and half the costs. High resolution digital camera should be used for aerophotographing.
- b) To produce the digital bird's-eye photomap, a new software for map processing should be developed or purchased due to new technology.
- c) To meet the requirement of printing, image resolution should higher than 300 dpi. It 's better to set shadow for the character notes in the map so that there will be an impending effect and enhance the third dimensional effects.
- d) In our printed BaoDing digital bird's-eye photomap, the roads can not be seen clearly. When the map scale is smaller than 1 to 7000, the road should be sketched with different colors so that it could be seen more intuitively(see chart 5).