

TWO FUNCTIONAL SOFTWARE FOR INTERNAL USE; FLIGHT PLANNING AND PRESENTING OF DIGITAL ORTHOPHOTOS

A.S. Demirel^a, H.Akdeniz^a, O.Aksu^a

^a Harita Genel Komutanlığı , 06100 Cebeci Ankara, Turkey - (sdemirel, hakdeniz, oaksu)@hgk.mil.tr

Commission IV, WG IV/5

KEY WORDS: Photogrammetry, Planning, Software, Orthoimage, Photography,

ABSTRACT:

As parallel to the developments, base materials used in photogrammetry and application software are taking in process to develop. Uses of high resolution spatial images, digital image processing, digital products are some of these results. But photographs acquired from aircrafts, are still keep their considerable place in photogrammetry, because of their low costs and effective usages in various disciplines.

Image processing is the most important part of photogrammetry. But obtaining photographs and presenting digital products are also as important as processing images. For these purposes there are many commercial software. Here we developed software to serve these kinds of jobs. This software is developed according to request of our users, so they are much more useful for internal purposes than the other commercial ones.

First one is flight planning software. The purpose of the system is to reduce aerial survey operational costs by streamlining and speeding up the preparation and execution of the photo missions. This software has been formed with many useful tools for planning. These tools cover all the aspects of modern aerial survey photography: Digitizing, planning, taking photograph, reporting, archiving, besides the basic tools: zoom, print etc.

The other software is presentation of digital orthophotos with user friendly interface. The purpose of the system is to reduce costs of printing and to present the products to users as soon as possible. This software has ability of presenting place names and vector data on a digital orthophoto. Tools on the software are; zooming, adding or editing place names or coordinates, measuring length or area, printing image with or without data in scale, exporting images into other formats, adding or editing vector data.

1. FLIGHT PLANNING

1.1 Introduction

Photographs acquired from aircrafts, are still keep their considerable place in photogrammetry, because of their low costs and effective usages in various disciplines. Computers and GPS (Global Positioning System) technology, called airborne GPS, are also taken part into photogrammetric project. By using additional equipment with GPS technology, it can be able to navigate flight and determine camera exposure station, which is the major problem in photogrammetric project.

The flight planning is the first step in photogrammetric project. In order to use new technologies and to get optimum profits, it is required to prepare an efficient flight plan. Since GPS technology has been used successfully in photogrammetry, planning of a flight for acquiring aerial photographs can not be considered as separately. Nowadays, most of the planes, designed for aerial photography, have GPS and computer aided flight management system. To use these systems effectively, the first and the basic principle is preparing the flight plans in digital formats and entering these data to the system digitally.

The main goal of planning is finding out the best fit flight lines and camera exposure stations. In order to cover the project area with minimum number of models, flight lines and camera

exposure stations must be planed carefully. This is also important for a safety flight, reducing aerial survey operational costs and speeding up the preparation and execution of the photo missions and flight.

1.2 Planning

The first step of a planning is determining of the project requirements. Considering the requirements of the project, project area, photo scale, end lap, side lap, direction of strips, coordinate system, camera type and film type are determined. According to these data, base distance between two exposure stations along flight line and the distance between two adjacent flight strips are calculated. The flight height is calculated for each strip by checking the terrain height of related strip. After that, coordinates of exposure stations are obtained.

Photo scale is selected depending on the project purposes, such as the desired accuracy of final product, purpose of use etc. The smallest possible photo scale is selected because of reducing the number of models. But this scale can not be selected four times bigger than final product scale to identify the details need for desired accuracy.

One of the wide or normal lens camera types is selected according to characteristics of the project area. In generally, wide lens cameras are preferred for the area that is smooth and

normal lens cameras are preferred for the area that is hilly or urban area.

In photogrammetric applications, in order to obtain stereo model, end lap is assumed to be 60%. To cover the project area completely with stereo models along strips, side lap is assumed to be 30%.

The flight line directions are generally planned in East-West or North-South direction. The flight line direction might be in different direction in some cases. The land limitations such as mountain range, lake, and seaside affect planning of the flight line directions. In these situations, flight lines are planned parallel to these details. And also needs of cross strip affect planning of the flight line directions.

Calculating the flight height is also taken an important place in planning. Selecting a lower altitude for flight causes photo scale to be greater than desired scale and causes the laps to be smaller than desired ratio. This situation might cause gaps between models and strips, and causes need of additional flights.

All these processes are time consuming processes and must be performed carefully. Any carelessness or mistakes might cause many errors in the future. To eliminate most of these errors that might be occurred in the future, using software for calculations and preparing all plans in digitally are considered as the best method.

1.3 Flight Planning Software

This software is developed according to request of our users. The software is intended to prepare flight plans in digital format. The software is formed with many useful tools for planning. These tools cover all the aspects of modern aerial survey photography: Digitizing, planning, taking photograph, reporting, archiving, besides the basic tools: zoom, print etc.

In order to start a project, the project requirements must be entered to the system in the project definition step by using project definition window shown in the figure 1. These are;

1. Project name
2. Project manager
3. Brief definition of project
4. Project area
5. Project owner
6. Focal length of camera
7. Film type
8. End and side lap ratio
9. Average terrain height
10. Min. and Max. change ratio in scale or laps

According to this information, the software automatically calculates other necessary information for plan. Base length, distance between strips and flight height according to average terrain height are calculated in this step.



Figure 1. Project definition window

Next step is planning the strips, single photos and control points. In main window shown in the figure 2, all planning process can be applied. Raster or vector data can be used as base map for planning. Coordinates can be entered by using base map directly or entered manually. Tools in the main window for planning strips are;

1. Create
2. Copy to next
3. Delete
4. Rotate
5. Move
6. Divide
7. Make extend
8. Make shorten
9. Enter terrain height manually

Tools for planning single photos are;

1. Create
2. Move
3. Delete
4. Rotate
5. Enter terrain height manually
6. Enter coordinates of exp. Station manually

Tools for planning control points are;

1. Create
2. Move
3. Delete
4. Enter coordinates manually
5. Read coordinates from file

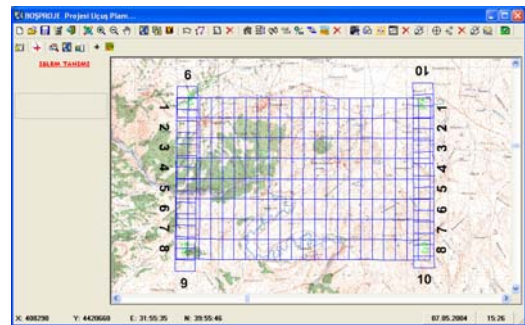


Figure 2. Main window

For the strips it is also available entering terrain height automatically. By using appropriate DTED (digital terrain elevation data), flight heights can be calculated automatically. For this process, window shown in figure 3 is used.

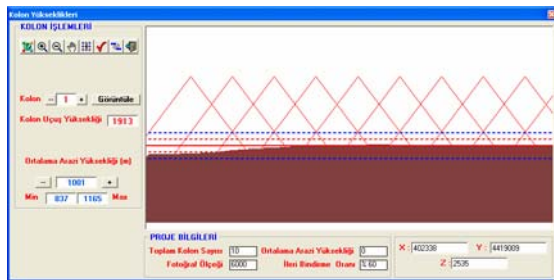


Figure 3. Terrain height window

In this step average terrain height of each strip is calculated from DTED. In the figure average terrain height along the strip, minimum and maximum limits for laps and scale are seen and edited manually or by selecting automatic mode, flight height for all strips in the project are calculated.

Additionally to these tools, some extra tools can be used for utilities. The utility tools that can be used while planning are;

1. Customize the project: Line thickness, display color for strips, single photos, control points etc.
2. Zooming process: All, in, out and pan
3. Add base map: Vector (CAD format), Raster (tiff, jpeg, bmp, MrSid, etc.)
4. Edit base map option: show, remove, color, thickness, fill, find etc.
5. Measure: Length or area
6. Add project area by drawing
7. Export plan to image format: tiff, jpeg, bmp etc.
8. Print plan with project information
9. Create report of plan in text format: Project information, coordinates etc.
10. See coverage of each strip or coverage of photo in a strip

After preparing plan, a plan diskette is prepared for flight. In this diskette, there is all project information necessary for flight mission. With the aid of GPS and computer in the plane, the flight is performed as it is planned and as it is desired. During the flight mission, coordinates of camera exposure stations are determined. After the flight, coordinates of camera exposure stations and after flight information are stored in the plan diskette.

By using after flight information diskette with the software, all information about flight mission can be obtained. It is also possible to edit and plot. Some of the tools for this purpose are;

1. Import after flight report
2. Plot
3. Edit: Name format of exposure station, display color, line thickness etc.
4. Check exposures
5. Remove unused exposures
6. Set starting number for photos.
7. Prepare report
8. Print

9. Compare pre and after flight coordinates of each photo
10. Create photogrammetric blocks

2. PRESENTING OF DIGITAL ORTHOPHOTOS

2.1 Introduction

Presenting a product is final process for a project. The success of a project is mostly depends on presentation success of it. Especially the digital products have much more change according to hardcopy products.

In photogrammetry the digital products have become very popular due to their diverse of use. Applications in many disciplines integrate the existing line data with the digital images. One useful and very common integration is that the orthophotos. Orthophoto is a planimetrically correct orthoimage on which measurements of terrain geographic location, distances, angles, and area can be made. On an unrectified imagery, such measurements can only be approximated due to relief and image displacements. Digital orthophotos have quite advantageous for providing a base for a new data set or for updating existing databases. The other significant advantage of digital orthophotos is that they provide a more readily usable data source for a GIS when compared with conventional data sources.

Various computer software packages now make it possible to presenting digital products. Once very expensive and complicated, some of these commercial packages are surprisingly affordable, run on standard desktop computers, and require minimal training to use. Here we developed software to serve these kinds of jobs. This software is developed according to request of our users, so they are much more useful for internal purposes than the other commercial ones.

The other software is presentation of digital orthophotos with user friendly interface. The purpose of the system is to reduce costs of printing and to present the products to users as soon as possible. This software has ability of presenting place names and vector data on a digital orthophoto. Tools on the software are; zooming, adding or editing place names or coordinates, measuring length or area, printing image with or without data in scale, exporting images into other formats, adding or editing vector data

2.2 Software for Presenting Digital Orthophotos

This software is developed according to request of our users. The software is formed with many useful tools for users. It is easy to use and it can be easily adapted to new conditions. Presenting digital orthophotos have three parts. First part is software. Second part is digital orthophoto and the last one is database. All these three parts are set in one CD-ROM. Users can easily setup the programme and run it. When a new version of one of these data is produced, it can be easily replaced by new one. Users also have an opportunity to add or edit database. The software has a starting window shown in figure 4. This window allows selecting digital image and related database.



Figure 4. Starting window

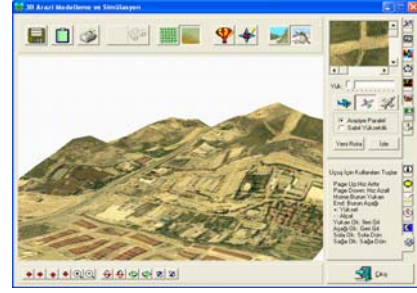


Figure 7. 3D view window

After selection step, according to the selected area the main window shown in figure 5 is started.



Figure 5. Main window

By using the tools on the main window, users can be able to do following studies.

1. Zoom process : Zoom all, zoom in, zoom out and pan
2. Database process : Add new data , edit name, edit coordinate, copy and delete existing data
3. Measurement : Coordinates, length and area
4. Print: With or without scale by creating a map composition shown in figure 6
5. Export to: Export seen part of image with or without names and vectors
6. Vector process: Create vector layer on map. Point, line or polygon or predefined styles can be added with desired color and line thickness or deleted. Save vector layer or load existing one to the system.
7. 3D process: Create a 3D view of seen image using appropriate DTM in a new window shown in figure 7
8. Help



Figure 6. Print window

The software has also additional tools. One of them is general overview window in which users can see the whole area and navigate the main window image. By using the list consist of most common place names, users can be easily find place on the map by selecting it from list. Names can be seen in the main window on their exact places if users wish.

3. CONCLUSION

As parallel to the developments, base materials used in photogrammetry and application software are taking in process to develop. Uses of high resolution spatial images, digital image processing, digital products are some of these results. But photographs acquired from aircrafts, are still keep their considerable place in photogrammetry, because of their low costs and effective usages in various disciplines. Presenting digital products is also as important as obtaining photographs.

In today's rapidly changing world, you need current information to make update. Maps are months or years old by the time they are printed but you can have a image in your hands a couple of days after it is acquired. An orthophoto is the most up-to-date map available. Digital orthophotos have no fixed scale. However, there is a limit to the scale of maps and hardcopy images. So adapting to new conditions will be much easier, if products are produced in digital format. Using your own software gives you adapting to new situations as soon as possible. And also it can be easily adapted to your system.

References from Journals:

Gruen, A.W., 1988, Digital Photogrammetric Processing Systems Current Status and Prospects, ISPRS88..

References from Books:

Kraus, K. And Waldhausl, P., 1993, Photogrammetry, Volume 1, Ferd. Dümmlers Verlag, Bonn

References from Other Literature:

Gruen, A.W., 1988, Digital Photogrammetric Processing Systems Current Status and Prospects, ISPRS88..

Altan, M. O., 1998, Why Digital?, Symposium on digital Photogrammetry, İ.T.Ü., İstanbul.