

# PHOTOGRAMMETRY AND REMOTE SENSING ON THE EVE

## XXIII ISPRS CONGRESS

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The rapid development of science and technology significantly influenced for photogrammetry (P) and remote sensing (RS), which appears in many works of authoritative scientists and leading companies.

As you know our industry experts, once in 4 years conducting Congress of the International Society for Photogrammetry and Remote Sensing (ISPRS), which summarizes the development of the sector and outlines directions for further research and practice. XXII Congress was held in August-September 2012 in Melbourne (Australia), and the next will take place in 2016 in Prague (Czech Republic).

In the period between the Congresses are eight commissions, which organize conferences, workshops, seminars etc. to exchange experiences and achievements.

Subjects of each commission is directed at resolving the problems and tasks that already laid down in its title Commission.

To orient the reader to the issues of activity of the Society, we submit names of committees:

Commission I: Scenes systems and carriers for remote sensing.

Commission II: Scientific theories and concepts of spatial information.

Commission III: photogrammetric machine vision and image processing.

Commission IV: Geospatial databases and local base services.

Commission Y: Short basis image - processing and application.

Commission YI: Education, technology transfer and capacity building.

Commission YII: Thematic processing, modeling and analysis of remote sensing data.

Commission YIII: The use of remote sensing and politics.

In this work, the author presented his vision of the current state of field and trends for future development.

**Objects of research.** Classic F and RS have been studying a wide range of objects: from micro to macro. Also in the field of research and practical work were diverse processes and phenomena of nature. Nowadays, thanks to the emergence of new technical means of collecting of primary data at a higher level have risen informative, efficiency, accuracy and quality of information about the object. It should also be noted that there was expansion of the list of the studied phenomena and processes; our branch is due to original theoretical, hardware, technology solutions.

**Research Methods.** F and DZ as an applied in the field of knowledge are used theoretical and experimental approaches and new information tools are analysis, synthesis, analogy and modeling. These known postulates for F and DZ scored slightly new meaning at this stage. Very important role in the study of the object by means of F and DZ play simulation. Digital model of the object, digital terrain models, digital elevation models, digital models coverage of the territory - is not only terms, but also at the same time means studying the object, and the results of production activities. Analysis also got a bright color, as it is transformed into Geoinformation analysis. For example, data from the hyperspectral crew system, with a combination of different channels allow to reveal new information of object characteristics. Consequently, new technical means contributing to the development of methods of professional studies.

**Theoretical achievements.** F and DZ allow to obtain an image of the object in analog or digital representation. The modern theory of image processing relates its two components, which we call "geometry" and "radiometry". The geometrical component provides a mathematical object identity

and image. As the image is formed filming system, it should be perfect. In addition, the path of the ray (radiation) should not deform the geometry of the image. Therefore, among the theoretical problems put forward one of the first places calibration imaging system and study the influence of the environment. As we see, the classic problem is still relevant.

Radiometric characteristics recorded by crew systems can be improved. This problem is theoretical plan and it is consonant with the scientific discipline "Digital Signal Processing".

Another theoretical problem, which for many years has been the subject of research, and that does not have a complete solution - is automatic decoding of images. Identify the quality characteristics of the object of his image without human intervention - a problem that waiting to be solved.

Other theoretical developments concerning aspects of mathematical processing of photogrammetric measurements. As an example - the problem of alignment of geospatial data at the Gaussian deviation of the distribution of errors (important when an automatic rejection errors of measurements, building elevation model, etc ..)/

Among the theoretical lines of research is the improvement theory of correlation signals, optimization of optical densities.

Mathematical modeling of processes and phenomena due to their variety, remains important, especially when it comes to space-time modeling.

**Sensors.** In comparison with the past century, when the main sensor in the F and RS were a photographic tape, now their list and physical characteristics considerably expanded. Almost involved the whole spectrum of electromagnetic radiation

Sensors oriented to register radiation in the atmospheric transparency windows, light (visible, near and middle infrared), thermal and radios frequency. As an example, we present data on the satellite system WordView-3 - 13 August 2014 launch. in orbit at 620 km. In short the system installed infrared sensor with a resolution of 3.7 m, the sensor CAVIS (clouds, aerosols, water vapor, ice, snow) with a resolution of 30m. Panchromatic sensor has a 31 cm resolution, and color to 124 cm.

Other examples are: the terrestrial laser-scanning device used in Topcon GLS-1000 radiation (pulses) in the unseen range of the electromagnetic spectrum.

If air laser scanning, then sensor is the light-sensitive semiconductor device. The choice depends on the wavelength of the laser functions and its safety to the human eye. It was established that the infrared laser wave 1550 nm is safe. In radarometry receivers use radio waves in the microwave range from 1 mm to 1 m.

When using hyperspectral satellite systems is used wave range of 0,4-5,0 m with the number of channels from 60 to 512.

Thanks to the development of optics, microelectronics, laser and radio sensors are constantly improved; they form images with high geometric and radiometric characteristics.

**Aircrafts.** On the use of airplanes and helicopters with Aerial Photography sufficiently stated in the literature. It has become common that powerful companies who specialize in Aerial Photography with the performance of their vehicles, and these technologies are well spent.

Indisputably, in the last few years, "boom" -not anticipated event was the massive use of unmanned aerial vehicles (UAVs) for aero photography primarily small areas. Obvious that, this is due to the increase aerodynamics vehicles and their relatively low price. Admits that the world engaged in manufacturing UAVs hundreds of companies, but for aero photography, their number is much smaller.

Important is the fact that "cartographic" UAVs has small format digital camera (it should be calibrated), and image processing is automatically completed and delivery of finished products (orthophotoplans).

In the last 10-year period developed landline mobile laser scanning. Here equipment carrier can be any mobile platform (car, train trolley, boat, etc.).

Created mobile complexes that include a scanner (often 3D and 2D), video cameras, inertial-navigation device (INS), a system of GPS, other registration device. Field of application is very broad and it can be attributed to the application of photogrammetry.

Spacecraft as carriers of imaging equipment - a traditional solution described in many publications [2]. Relatively new solution-oriented and cheaper launch vehicles is the use of a series of small and micro satellites.

**Software.** Software systems are continuously increasing their capabilities, oriented on the automation of some processes of photogrammetric processing and decoding of images. Concern occupies leading positions- Hexagon, which included in its membership companies Leica Geosystems, Intergraft, Erdas, Z / I Imaging. An example of its activity is hardware-H2O (Hydrology Overall Solution), designed to solve issues early warning of emergencies, including related to the monitoring of large dams and reservoirs.

Other examples are software suite Inpho (Trimble), which covers almost all photogrammetric tasks, including creating orthophoto, screen and graphic visualization of point clouds, etc ..

A software solution for specialized tasks, such as mapping, modeling and planning of urban areas. GeoCityModelling program allows processing data obtained by shooting aerial and space systems. An interesting touch application are automatically collect data on buildings and 3D modeling in automatic mode.

There is a tendency an integrated approach to data DZand F with geoinformation systems. This direction is Chinese firm GEOWAY, which created a powerful package for processing of aerospace images. Module GIS DATA Processing System is aimed at building a GIS.

This trend, which is mentioned in our previous review [1], stored and distributed. In addition, it should be noted that the list of software developers every time increases and the possibility of data processing DZand F rising. Review of existing programs and analysis of their opportunities may be subject to a separate study.

**The impact on society. Politics.** Global phenomena and processes affecting human livelihoods, individual countries or regions. Therefore, experts of our industry is not standing aside these challenges, which give us and nature, and unfortunately, economic and political

activities. Therefore one of the commissions ISPRS, namely Commission VIII formulated the main directions of the activity:

- Promoting measures aimed at improving the climate of the planet;
- Integration of terrestrial and satellite observations that promote long-term quality of weather forecasts;
- Development of strategies and methods for the integration of Fand DZ in assessment of areas, including biochemical parameters and monitor the cryosphere;
- Continuous monitoring of land use, vegetation, providing high-quality water, air and other components of the biosphere;
- Strengthening the role of Fand DZ in the monitoring of emergency situations, monitoring the impact of negative factors on the environment and human health;
- Activation of the role and place of Fand DZ technologies in the energy and mineral resources management;
- Cooperation with international organizations and programs that are relevant to mentioned above problems.

This extremely complex field of activity at the same time is very difficult. We know how difficult it is to reach out to officials of different ranks and convince them of the desirability implementation of research results, methods and technologies. However, we must act, and often-international nongovernmental organizations consolidating their efforts achieve success.

### **General conclusions.**

Photogrammetry and Remote Sensing belong to high technology areas. Their information capacity has increased significantly and this trend continues. Do not forget that the introduction of new methods and technologies necessary personnel, highly educated and highly skilled. This is not only universities, but also industrial structures. Hope that our well trained (theoretically and practically) professionals will develop our industry and attain new heights. This dialectic of progress and development.