REMOTE SENSING AS A TOOL FOR NATURE INVENTORY

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One of the important problems of development of the economy is a multi-purpose inventory of natural resources, monitoring and protection of environment, management of natural wealth consumption and reproduction.

Experiments in remote sensing, carried out in the USSR, proved expediency of a special space system of land resources inventory and environment monitoring for the benefit of different branches of the national economy.

Space imagery as compared with conventional one has a number of advantages, which are mainly inherent in the use of a space-born carrier: altitude and orbital velocity. These advantages involve:

- reduction of costs of surveys;
- practically inlimited overview (from local to a global one);
- high efficiency of data accumulation due to orbiting speed of the spacecraft;
- feasibility of data aquisition on remote areas: islands, sea and ocean regions;
- trustworthiness and authenticity of data;
- wide application of standard models in interpretation and use of highly efficient automated systems for image processing entailed by aquisition and processing of data with simular patterns for numerous objects under the same conditions;
- increased labour efficiency and reduction of costs of space imagery processing due to wide overview and uniformity of data;
- feasibility of exploration from general to particular, while conventional surveys are based mainly on systematic approach and generalization of numerous labour-consuming separate observations.

Analysis of trends in technology of land remote sensing from space proved expediency of development of continuously operated, multi-functional, complex system with high level of automation of image aquisition and processing.

Systematic approach to the formation of notions on all-state system of land resources inventory and environment monitoring rendered the most efficient and expidient ways of its elaboration. It allowed to optimise its information capacity, precision, operational efficiency and reliability to fully meet needs of the national economy. The All-state-space system of land resources inventory and environment monitoring may include the following main components - both continuously

functioning and optional ones:

- manned spacecrafts;
- Meteor-type spacecrafts;
- Cosmos spacecrafts;
- air-borne laboratories;
- ground recieving stations, performing multi-purpose processing of imagery;
- network of land and sea test-sites;
- mobile units for contact and close-range observations;
- stationary contact measuring equipment;
- network of instruments and systems for imagery processing inside different branches of industry.

Let us discuss the purpose of system's components. Manned spacecrafts play a special role in land inventory from space. They are intended for experiments, research and production work with remote sensing, perfection of sensors, visual and visual-instrumental observations besides many other tasks. First observations of the Earth, first photo-surveys were made from manned spacecrafts. They gave confidence in future of space technology for nature inventory. Space orbiting stations of Saljut type carry various instruments, including those of considerable weight and dimentions, with high consumption of power. Thus comparision of different sensors under comparable conditions can be done for different tasks of remote sensing. Optimum conditions for exploitation of the sensors can be found with participation of an operator.

Many experiments performed by cosmonauts on the orbiting stations formed a base for technical specifications for new instrumentation, methods of survey and application of space technology in the national economy. Automatic spacecrafts of Meteor type solved only meteorological tasks on the first stages of their work. Satellites of this type aquire and transmit data to ground receiving stations by radio. It was proved expedient to aquire and use imagery obtained by these satellites for different branches of the national economy, besides their main meteorological application.

Meteor satellites were continuously improved, the quality of imagery and resolution increased. Therefore it became expedient to apply the Meteor imagery for studies of patterns of rapid developments on the Earth surface and solution of tasks which need panoramic overview and moderate resolution.

Cosmos satellites are equiped with different instrumentation for land resources inventory. They are aimed at continuous aquisition of high-quality imagery for the national economy and for solution of long-term tasks for industry and science, for the Earth surface studies, mineral wealth exploration, vegetation cover studies, sea and ocean region exploration, studies of shoals of sea-shelf.

Flying laboratories aboard special aircrafts are used in land resources inventory systems for research work to develope new methods and instruments for remote sensing, to carry out sub-satellite experiments for aquisition of imagery with high resolution.

A network of land and sea test-sites is included into the system of land resources inventory from space. The test-sites represent the characteristic physio-geographic regions of our country, and they are evenly distributed over its territory. The sub-satellite experiments, and complex inter-disciplinary research aimed to develope instruments and methods for remote-sensing are carried out at the test-sites.

The sub-satellite observations are carried out with mobile and stationary units and with contact and close-range observations. They render specifications for development of improved instrumentation and methods of interpretation and so on.

Remote-sensing imagery obtained from space is sent to all-state inter-disciplinary centres, and from there, after being properly processed, it is sent to user-agencies for their exploration work in land resources inventory and environment monitoring.

Space imagery is widely applied for solution of many scientific problems and industrial tasks. Not much time elapsed since space imagery became available for exploration of land resources, but nevertheless there are considerable successes in nature inventory from space.

Using space imagery ore deposits, oil and gas fields were found, forests are studied, remote areas are mapped, seismic hazards are estimated, ice situation is forecasted for navigation in Arctic ocean, and so on.

With rapid development of giant territorial-industrial complexes in the USSR such inventory of land resources becomes especially important. For estimation of land resources and selection of strategy for their use in industry, for elaboration of projects and land management, space survey renders trustworthy, comprehensive and promt initial data. Unknown preveously natural wealth can be found using method of analogy for interpretation of imagery obtained from space.

Investigations and complex studies of land resources and at the first stage - land resources inventory proved to be highly efficient.

Application of space imagery to monitore and protect the environment, for reproduction and efficient use of land resources is urgent. Repeated in regular time-intervals surveys from spacecrafts provide valuable data for solution of the above

problems.

Development of highly efficient systems for data processing is one of the tasks of nature inventory from space. High orbital velocity and big altitude of satellite allow to cover during 5 minutes of survey the same area, as that covered by airsurvey with modern aircraft during two field deasons. That is why urgency of development of special industry for computer-aided space imagery processing is evident.

To improve the extraction of nature-inventory information from space imagery is a pressing problem. Available in different countries equipment allows to interprete only part of information on land resources and environment inherent in remote sensing data.

Future instrumentation for space imagery processing should meet the following requirements. Firstly, it should render full extraction of nature-inventory information from space imagery. Secondly, it should be highly efficient for processing of large files of remote sensing data from space.

The hardware should be designed in separate units. Thus from the separate components one could build the required technological currents providing the needed information. It is expidient to design inter-active units of hardware for multi-purpose and single-purpose data processing systems.

Utilization of new electromagnetic wave-bands, application of active radiation, use of all-weather systems for data aquisition are urgent problems of remote sensing.

The trends of nature inventory from space promise in future even more important role of remote sensing for the development of economy.