Resurs-P Spacecraft: Imagery Data Application

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A peculiar feature of the Resurs-P spacecraft that distinguishes it from the most of ERS satellites is that it carries out the integrated observation of the Earth surface with the use of a number of on-board optronic equipment. Capability of simultaneous imaging by different types of equipment increases the efficiency of solving a broad spectrum of socio-economic tasks and applied problems in the field of global monitoring and environmental protection.

The high-resolution equipment permits to acquire images of large areasacross the 38-kilometre swath in panchromatic mode at resolutionnot exceeding 1-metre and in six-narrow-band multispectral mode at 3-metre resolution; this makes it possible to fulfill a broad spectrum of thematic tasks:

− creating and keeping topographic, digital and special maps up-to-date;
− digital photomapping, orthophotomapping and general planning of towns
− 3D and digital terrain modeling;
− inventory and construction monitoring of infrastructure projects;
− forest inventory and management;
− inventory of agricultural lands and planning of land utilization;
− monitoring of transport and power lines;
− exploration of natural resources;
− environmental monitoring;
− nature management;
− etc.

Diverse combinations of spectral bands make it possible to obtain composite images in true and false colors enhancing visual decoding of images, and indexed images, particularly Normalized Difference Vegetation Index (NDVI).

By merging two images acquired from extreme OptronicImage Converters, the focal plane of the high-resolution equipment permits to obtain a stereoscopic image (anaglyph) enhancing visual decoding of target areas.

Large-swath multispectral imaging equipment enables wide-swath detailed imaging at 12-metre resolution across the 97-kilometre swath and at 60-metre resolution across the 441-kilometre swath ensuring simultaneous imaging in panchromatic and 5-band multispectral modes.

Among the main application areas utilizing images produced by the large-swath multispectral imaging equipment:

− creating and keeping medium-sized topographic maps up-to-date;
− thematic mapping;
− monitoring of agricultural lands, including:
− location of sown areas;
− determination of field boundaries;
− crops monitoring;
− crop forecast.
− forest management, including:
− detection of areas damaged by fire, insects and other disasters;
− forest type determination;
− inventory of forest;
− reforestation control;
− detection of unauthorized deforestation.
− monitoring of hazardous natural phenomena (waterlogging, desertification, salinization, etc.);
− detection of forest and steppe fires;
− monitoring of areas subject to flood;
− natural disaster damage evaluation;
− environmental control of water bodies.

Multi-date composite images acquired from the large-swath multispectral equipment can be efficiently merged into sets of vector GIS coverages containing data on changes occurred over wide areas.

Hyperspectral imaging equipment provides imaging in visible and near-infrared ranges in no less than 96 bands at 25-metre resolution across the 25-kilometre swath.

Hyperspectral imagery makes it possible to create thematically associated products in the form of various thematic maps and geographic information systems (GIS) with signatures of physicochemical and biological composition of natural and anthropogenic targets including:

− quality of water in water basins and rivers; mechanical, chemical and biological pollution of water areas;
− soil salinity rate;
− mineral composition and texture of soil, crop-

producing power;

− state of plant cover, agricultural lands and forest;

− illegitimate drug plantations;

− chemical and biological discharges into the air, water basins and rivers;

− areas contaminated with sludge of hydrocarbons, chemicals and other harmful substances;

− disposal tips;

− leakages of hydrocarbon, ammonia and other aggressive chemicals from trunk pipelines;

− ecological state of gas, oil and chemistry-companies, heat and power producers;

− state and composition of rocks; open-pit mines; geological exploration;

− objects of cultural and architectural heritage;

− state of coastal zones;

− etc.

Hyperspectral data can be efficiently used for solving difficult-to-formalize problems such as segmentation and classification of targets, integration of diverse information, etc. Knowledge of spectrum signatures of natural and antropogenic objects permits to automate the process of their detection and classification in hyperspectral images.

The report represents the results of the Resurs-P data application for solving a broad spectrum of socio-economic tasks.