CREATION OF INTERNATIONAL AEROSPACE SYSTEM FOR MONITORING OF GLOBAL PHENOMENA

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PURPOSE AND TASKS OF INTERNATIONAL AEROSPACE SYSTEM FOR MONITORING OF GLOBAL PHENOMENA

PURPOSE: Global monitoring of Earth’s surface, Earth’s atmosphere and near-Earth environment from space with the possibility to transfer observation data to ground situation centers which carry out forecast and warning in quasi-real time to prevent natural and man-caused disasters.

AIM: Decreasing of danger and negative consequences of natural and man-caused disasters for population and economic potential of countries on the base of creation of united scientific and technical and informational space in the field of monitoring of Earth lithosphere, atmosphere and ionosphere.

This aim is achieved by means of effective development and mutual use of space potential, advanced monitoring technologies and procedures for data processing which different countries have in the interesting of providing the global operational and short-term forecast of natural and man-caused disasters.

MAIN TASKS OF SYSTEM

- Remote observation of Earth’s surface, atmosphere and ionosphere with use of visible and heat range equipment, low- and high-frequency wave complexes, complexes for monitoring of charged particles, magnetometers, mass-analyzers, spectrometers,
- Data obtaining by satellite equipment and its registration,
- Transfer of monitoring data from satellite to ground centers to obtain, store and process the Earth observation information both in real-time and with delaying in case of data storage in satellite on-board memory,
- Preprocessing of Earth observation information with use of ground stations which are part of global (international) and national situation centers,
- Monitoring data acquisition and processing in the interesting of operational and short-term forecast of natural and man-caused disasters, and data storage and display in the international situation centers as well,
- On-line and operational delivery of necessary information to state authorities both in Russia and in other countries in the interesting of hazard reducing and decreasing of negative consequences of natural and man-caused disasters for people and economic potential of different countries,
- Remote education (distance learning) in the interesting of training specialists in the field of monitoring, forecast of natural and man-caused disasters and other areas of science and engineering with use of advanced space and informational technologies
- Providing with data for weather analysis and forecast on regional and global levels.
STRUCTURE OF INTERNATIONAL AEROSPACE SYSTEM FOR MONITORING OF GLOBAL PHENOMENA

SPACE SEGMENT
- Satellite constellation on geostationary orbit (GEO)
- Satellite constellation on sun-synchronous orbit (SSO)

AIR SEGMENT
- National aviation constellations for Earth observation

GROUND SEGMENT
- Ground technical facilities
  - Ground complexes to provide flights
  - Launchers for injection of satellites to GEO
  - Launchers for injection of satellites to low-orbit
- Global system to provide with monitoring information
  - Subsystem to obtain data of earth remote sensing
  - Subsystem to obtain data from air segment and control sensors
  - Subsystem to process obtained observation data
  - Subsystem to provide information concerning geophysical phenomena and disasters forecasts
- Ground control complex for GEO's satellite constellation
- Ground control complex for low-orbit satellite constellation
- Ground complexes to subsystem to obtain data of earth remote sensing
- Ground complexes to subsystem to provide information concerning geophysical phenomena and disasters forecasts
- Ground complexes to subsystem to process obtained observation data
- Ground complexes to subsystem to provide traffic passages
- Ground complexes to subsystem to provide customers with high-precision navigating data
- International navigating-informational system
  - Integrated telematic system to provide traffic passages
  - Team terminals
  - Main technical centers
- International remote education system

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SIGNS OF EARTHQUAKES REGISTRATED BY MEANS OF SPACE SYSTEMS

- Anomalies of cloudy fields
- Anomalies of gravitation field
- Magnetic heterogeneity
- Level of subsoil waters
- Heat anomalies
- Removal of Earth surface
- Dying Ionosphere
- Mature cyclone
- Birth of tsunami
- Tsunami rising
- Ionosphere disturbance

MONITORING OF TSUNAMI EVOLUTION

ESTIMATION OF CONSEQUENCIES OF NATURAL DISASTERS

Before tsunami

After tsunami

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Main technical characteristics

- Mass (max) – 150-160 kg.
- Mass of payload - 20÷40 kg.
- Lifetime – 5 - 10 years.

Orbital structure:
Number of satellites in constellation – 12.
Orbits - SSO, H=575 km, with even distribution of orbit planes along longitude of ascending node

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<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
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<tbody>
<tr>
<td>- resolution, m</td>
<td>3 – 60 (panchrome);</td>
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<tr>
<td></td>
<td>8 – 125 (spectral)</td>
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<tr>
<td>- spectral range, micrometers</td>
<td>0,48 - 1,7</td>
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<tr>
<td>- span, km</td>
<td>20 - 510</td>
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STAGES OF CREATION OF INTERNATIONAL AEROSPACE SYSTEM FOR MONITORING OF GLOBAL PHENOMENA

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Researhces directed at:
- Specification of the system architecture,
- Analysis of technical and technological possibilities of creation of system’s elements,
- Further investigation of signs betokening natural and man-caused disasters and capabilities of corresponding equipment to register this signs,
- Technical and economic analysis of development, creation and operation of the system,
- Determination of requirements specification for development work to create system.

Carrying out of the development work to design and create system including:
- Development of system’s pilot project (2010),
- Development of draft design, development of experimental patterns and kea elements of system, development of technical documentation to manufacture preproduction (test) models, systems and mock-ups (2011 -2012),
- Manufacture of preproduction (test) models, autonomous tests and correction of technical documentation (2012-2013),
- Assembly tests and correction of technical documentation (2014),
- Flight tests, preparation of technical documentation for series manufacture of system’s elements, system’s commission (2015)

Deployment of system including:
- Serial production, launches and putting into operation,
- Extra equipping of ground control stations (if necessary),
- Deployment of orbital constellation of global system to provide customers with monitoring data,
- Deployment of international remote education (distance learning) system.


1st stage Research engineering 2nd stage Development work 3rd stage Deployment
HUMANITARIAN

- Maintenance of life and health for thousands people on the Earths due to online control, forecast and early warning about natural and man caused disasters,
- Increasing of comprehension by world community the necessity of peaceful coexistence on the Earth and preservation of world civilization

ECOLOGICAL

- Reliable estimate of influence of factors concerning ecological threats on the Earth,
- Increasing of efficiency of development and realization by world community the large-scale actions to prevent the ecological threats resulted from natural and man-caused factors

ECONOMIC

- Decreasing of unemployment due to opening new jobs,
- Preservation and steady raising of scientific, design and technological potential in Russia,
- Annual resources savings due to prevention of emergency situations dealing with natural and man-caused disasters (in the world – hundreds billions US dollars),
- Re-orientation of resources savings to humanitarian needs of humanity.
PATENT ON MONITORING SYSTEM IN THE INTERESTING OF PROTECTION FROM MAN-CAUSED AND NATURAL DISASTERS AND PATENT ON MULTIFUNCTIONAL SPACE SYSTEM FOR CONTROL AND MONITORING OF CRITICALLY IMPORTANT OBJECTS AND TERRITORIES

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FOR ATTENTION