THE GENERAL CONCEPTION OF THE MICROSATELLITE COMPASS TO STUDY OF THE EARTHQUAKES FORERUNNERS.

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ABSTRACT

The system of the small satellites can be especially important for revealing and research of global and regional net of geological faults in an effort to plan searches of mineral resources and to forecast destructive earthquakes (volcanic eruptions). The first microsatellite COMPASS, weighting 85 kg, is planned to launch to the circular orbit with height 400 km and inclination 79 degrees for development of the methods of monitoring and forecasting of natural disasters on the base of coordinated monitoring at the Earth and from space the pre-earthquake phenomena. The details of the measurements, instruments and general conception of the microsatellite system based on the COMPASS mission are presented.

1. INTRODUCTION

The deep tectonic faults are known to be zones of concentration of stresses, canalization of fluids, aerosols and gases, change of magnetization and electro-conductivity of rocks, appearance of high electrical potentials and so on. Also the tectonic faults are associated with the geodynamical structures which form the zones of elevated seismicity or zones of dangerous natural hazards.

Note, as early as 1979 the abrupt increase of intensity of the low frequency electromagnetic noise emissions was detected by satellite “lnterkosmos-l9” over a zone of earthquake being in stage of preparation or realization. The results of joint processing of the data of low-frequency emission, corpuscular flows as well as temperature and density of plasma permitted us to reveal the previously unknown effect of the generation of low frequency noises in space over the deep faults of the earth crust.

The method described above is the important addition to those being in use. By combining with another methods it allows solving the next problems:

-studying the faults as conductors of heat and fluid endogenous flows;

-revealing and studying the faults ,which are responsible for the distribution of oil and gas deposits;

-studying the tectonic activity of the faults and detecting the earthquake forerunners.

The realization of the method should be based upon investigation of the electromagnetic fields of different intensity and frequency as well as the heat fields with the use of complex system of information processing. Besides, the existing extensive data on earth surface

survey provided with television and photographic systems are going to be used.
The developing now in Russia method of ionosphere tomography also is very perspective for that .
To reduce the cost of remote monitoring of the Earth from space it is offered to place complete sets of the scientific equipment on the small satellites. To study spatial - temporary structure of geodynamic processes it is necessary to place at near-earth space large number of measuring systems of various assignment for long time measurements, i.e. launch of large number of small, specialized satellites equipped with a set of the standard measuring equipment for reception of the information on electromagnetic radiation in various frequency ranges.
Now, we are developing a new basic small spacecraft "Compass - Shtill" adapted for solving large area of the problems of faults.

2. PROJECT COMPASS

The main tasks of the project COMPASS are:
-development of the methods of monitoring and forecasting of natural disasters on the base of coordinated monitoring at the earth and from space the pre-earthquake phenomena;
-development of the methods of monitoring of man made catastrophes;
-study of electro dynamical coupling of the atmosphere,ionosphere and magnetosphere;
-development of the technology of the microsatellite;

The microsatellite COMPASS is planned to launch to the orbit on 2005 year to the circular orbit with height 400 km and inclination 79 degrees by "Shtill" launcher from submarine.
This microsatellite (MS) is designing by State rocket Center named after Makeev and IZMIRAN and supported by Russian Space Agency (Rosaviakosmos") and Russian Academy of Sciences Science.
The set of scientific instruments of the COMPASS includes (Table 1) :
-very low /low frequency wave spectr-analyzer;
-radio frequency wave spectr-analyzer;
-GPS/radiotomografy receivers;
-UHF transmitter;
-charged partical detector.
The COMPASS spacecraft (Fig.1) is one unite with 2 opening wings of solar panels, set of antennas and booms with the sensors. The spacecraft looks like four plane cutted pyramid. All the equipment is placed inside on the walls.The spacecraft is oriented and stabilized by 3-axies attitude control system. The attitude of the microsatellite will be calculated on the database of 3-axies magnetometer and solar sensors with the accuracy about one degree. GPS orbit determination will be used.
The system of power supplyement includes 4Ah Ni-Cd battery and about 1 m^2 of solar panels and provides up to 50 Watts and 27 Volts.

All systems and instruments of the microsatellite are controlled by central microprocessor, which provide the operation cyclograma, data collection, onboard data processing and telemetry and command lines interfaces. Data storage flash memmories provides up to 100 Mbytes. Data transmission is provided at the rate 64Kbit/sec by onboard telemetry via 8 Watts, 137 MHz transmitter and up to 1.0 Mbit/sec via 10Watts, 1700 MHz transmitter. The control link is at 137 MHz.
Ground based telemetry (137 MHz, 1700 MHz) and control equipment at 137 MHz are placed at Troitsk (IZMIRAN).

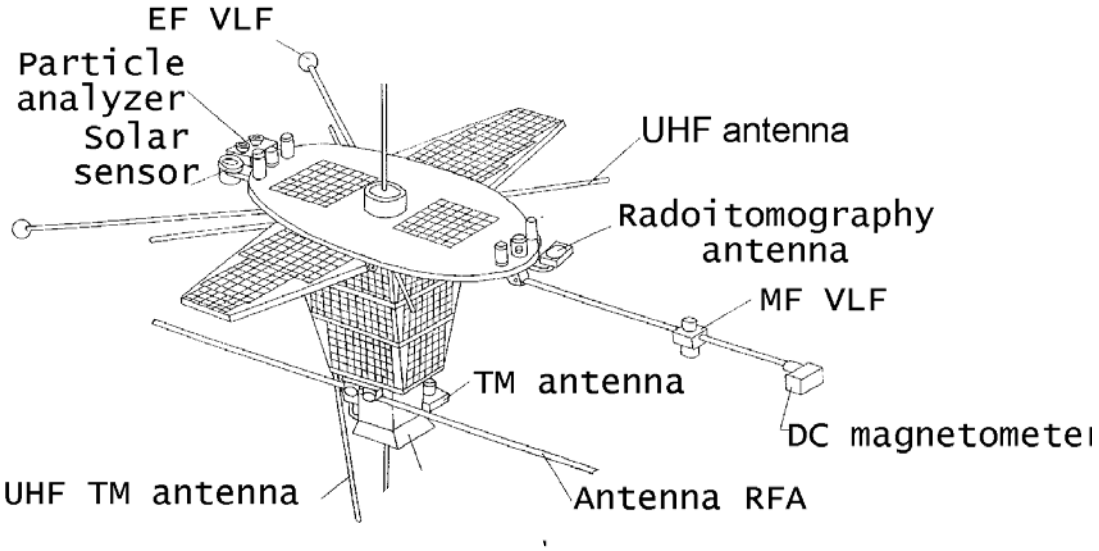

Fig.1. COMPASS microsatellite

Table 1

EXPERIMENT	ASSIGNMENT	INVESTIGATORS
NVK-ONCH SAS low-frequency wave analyzer	Measurement of a spectrum an electrical and magnetic components of low-frequency electromagnetic radiation (8-20000 Hz).	Institute of Terrestrial Magnetism, Ionosphere and Radiowave propagation, Russian Academy of Sciences, Troitsk,(IZMIRAN); Etvos University, Budapest: Lviv Center of space research,National Ukrainen Academy of Sciencies,Ukraine
RFA High-frequency wave analyzer	The spectrum - analysis of high-frequency electromagnetic radiation, wave form (0.1 - 15,1MHz)	Space Research Center, Polish Academy of Sciences,Warsaw, Poland, IZMIRAN
Tatyana	Partical detector + fotometer	NIIAYF MSU
ASN GLONASS/ GPS receivers	Radiotomography, determination of position -30 m,velocity-10cm/sec	IZMIRAN
UHF transmitter	Total electron content measurement	IZMIRAN