ACTIVE WAY OF REDUCING MICROACCELERATIONS OF SPACECRAFT BY USING ELECTRIC THRUSTERS

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Spacecrafts for technological experiments can be used in different spheres (i.e. metallurgy, electronics, medical science, biotechnology and so on) for producing experimental and industrial samples of materials and substances which are difficult to produce on the ground.

The stage of using special automatic spacecrafts for space industry began in 1975 by launching the satellite "Cosmos-1645". The regular study on space technology of orbital spacecrafts began with the experiments on space station "Salut-5" in 1976 and were continued on station "Mir". Over 100 experiments were conducted during this period on automatic spacecrafts "Foton" and over 300 were conducted on "Salut" and "Mir" stations. The experiments showed up better homogeneity, stoichiometry and structure of samples comparing to the ground ones.

The need of different materials with some special properties has raised recently. These materials can be produced only on spacecraft and the acceleration of the spacecraft and its stabilized platforms should be as small as possible. However we could not make the relative microacceleration $\leq 10^{-5}$ during the long period of time because of using chemical gas rocket thrusters and electro-mechanical stabilisation systems.

Microaccelerations can be greatly reduced by using specially designed electrorocket thrusters. System analysis conducted in Moscow Aviation Institute showed up that spacecrafts providing $n$ $< 10^{-6}$ during hundreds of minutes can be created. These experiments can be repeat up to 10 times on the same spacecraft. And after each experiment the sample is returning to the ground for studying and developing the program of the next experiments on the same spacecraft.
Automatic spacecrafts can be quickly developed on the base of existing spacecrafts ("Mir", "Foton", "Spectr" and others).

Automatic technological process control system can take orders from outside or use it's own adaptive program.

During the breaks between technological or medical-biological experiments or after them different space measurements requiring $n_g < 10^{-6}$ can be conducted.

Besides that other tasks can be solved:
- conducting spectral measurements from the orbit and transmission to the ground information for meteorology, ecological control, predicting the crops;
- conducting scientific researches of Solar-Earth connections, studying of the Sun and creating the space system for permanent Sun observation.

Two types of the orbits are the best for this purpose:
- circular solar-synchronized
- high apogee elliptic

The main advantage of the first type is that the spacecraft never comes into the Earth shade. The spacecraft can be put on 800 km altitude with the 97° inclination using the basic orbit with the 71.6° inclination.

The advantage of the second type is that the characteristic velocities are very low for smaller returning spacecraft. High apogee orbits with the 51.6° and 64.8° inclinations and the 1000 km pericenter altitude will provide small gravitational indications and allow to avoid the influence of atmosphere during the long flight. The altitude of apocenter can be the 300000 km for the 7 days period. Higher apocenter altitude can be reached by using 51.6° inclination.

The transfer of the returning spacecraft to the atmosphere entering trajectory and landing are provided by regular systems. This improves the reliability and simplifies the construction of the returning spacecraft. The automatic spacecraft together with the returning spacecraft are transferred to the entering trajectory. After that the returning spacecraft separates from the main one and makes the autonomous flight. After that the main spacecraft can restore it's orbit and continue working.

The weight of the automatic spacecraft is in the range
1.5...3 tones so using the rocket "Proton" is not required.

The weight of each of 10 samples returning to the ground is 10 kg.

The weight of additional scientific equipment can be up to 100 kg.

The resource of the automatic spacecraft is not less than 1 year.

Besides the autonomous flight the automatic spacecraft can interact with big spacecrafts "Space Shuttle", "Mir", "Alpha". It can provided by direct connection and information exchange as well.

Thus the suggesting project of automatic spacecraft with electrorocket thrusters allows:

1. To use in space separate units and systems which improves the reliability of the whole project.

2. To conduct different long lasting and adaptive experiment with the microaccelerations two or three orders of value less then now.

3. To provide the interaction between these spacecrafts and others: "Space Shuttle", "Mir", "Alpha".

4. To conduct long lasting precision space measurements.

5. To have minimum expenses of obtaining new scientific information on every stage of creating and using of these spacecrafts.

6. Developing, creating and using the new spacecraft should base on the wide international cooperation.

7. It is useful to make the group of representatives from interested countries and organizations to develop the program of this work.