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DEVELOPMENT OF THE ON-BOARD MEASURING COMPLEX OF THE OF THE ROCKET MODEL

The article deals with the results of the development and testing of the on-board measuring complex of the rocket model. The device of the complex and the principle of its operation are described. Prospects for further modernization of the complex are considered.

Keywords: *Model of a rocket, instrument compartment, measuring complex.*

The launching of the rocket models for the certain height requires registration of the basic parameters of the rocket flight for comparing the calculated theoretically and practically obtained data.

The purpose of the project is the development of on-board measuring complex rockets model. (The main technical characteristics of it are introduced in table 1.) This complex must register the altitude, speed and time of flight of

the rocket model and generate control system signal of rescue providing its small weight and size.

Nowadays the problem of registration of the flight data is solved by installing factory electronic measuring devices on the board of the model of the rockets. The most common and functional are Altimeter Two by American company Jolly Logic and flight controller "ComFly-030" by Russian Real Rockets.

The Altimeter Two is a digital barometric altimeter which is installed in the chassis model of the rockets. It allows recording the maximum and average parameters of a flight such as the altitude, time, speed, acceleration. It has small weight and size.

However, the Altimeter Two has the following disadvantages:

• High cost;

• Inability to generate control signals;

• Fixing only the maximum and average flight parameters;

• Inability to expand the functionality of the altimeter. [1, p. 21-22]

Flight Controller ComFly-030 fastened on the board of rocket model and can commit the time and height throughout the flight with the possibility of uploading data to a computer for analysis. The controller has 4 configurable channels governing to connect the on-board electrical system of salvation. Despite the broad functionality, this controller has the following disadvantages:

• High cost;

• Inability to fine-tune the flight program;

• Inability to altimeter tailoring;

• The necessity for additional power to the controller and the system of salvation. [2, p 94]

On the basis of these tasks in the project and the identified weaknesses of existing solutions on-board measurement system model rockets was developed. This complex has been implemented based on the Arduino nano v3.0

microcontroller, performing the role of digital processing, processor and a pressure sensor and temperature Bosh BMP280 (fig. 1).

To generate the control signal on-board measuring complex IRFZ44N field-effect transistor was installed acting as a transistor key. When a control signal is applied to it, the transistor switch opens and supplies current from the on-board battery to the contacts of the rescue system (fig.2.).

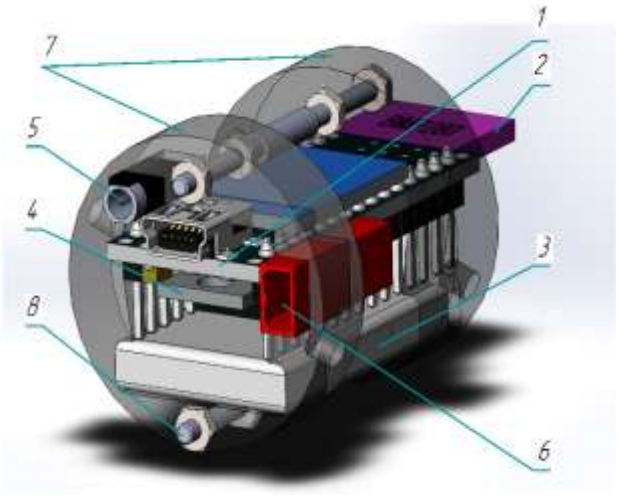

Fig. 1

Model of on-board measuring complex.

1 controller, 2-3 pressure sensor-battery system rescue, 4-transistor, 5-fee charging 6-contact connector system Rescue, 7-rack, 8-studs.

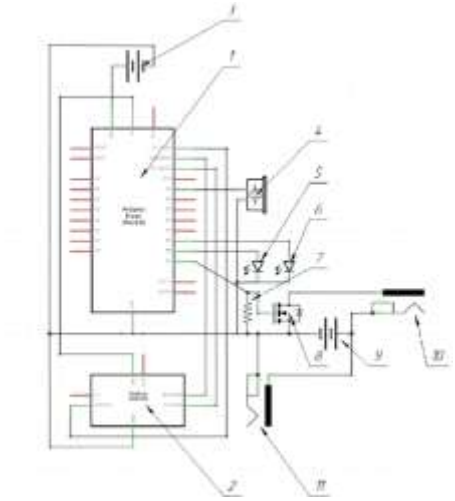

Fig. 2.

Electronic circuit on-board measuring complex.

1 controller 2-pressure sensor, 3-power supply electronics, 4-the piezoelectric element, 5.6-led, 7-resistor,8- transistor, 9- battery 10-connector system rescue, 11-battery charger connector.

To verify the correct operation of the program in the on-board measuring system, 2 LED indicators and a piezoelectric element are installed. The piezoelectric element also generates intermittent sound signals after the head unit landed, which simplifies the search for the rocket. [3, p. 47]

The program, loaded into the microcontroller, is developed in the open development environment of the Arduino IDE. Now a program has been developed that allows recording both maximum and intermediate values of the height and flight time of the rocket, and also generates a control signal of the rescue system. The complex is installed at the head of the rocket. Fixing of the complex is provided by prefabricated stands that compress the complex. The developed on-board measuring complex has a number of advantages in comparison with the currently offered factory alternatives.

- Ability to correct the flight program
- Ability to expand the functionality by connecting additional modules
- High reliability of storing rocket flight data
- Availability and low cost of components

Now, 10 test launches of rocket models were carried out with this complex installed on the board. In 100% of cases, the complex has fully completed its tasks.

Table 1

Main technical characteristics

Parameter	Setting
Operating temperature range without thermal insulation, 0C	-5..+40
Operation time without recharging, min	20
The working pressure of the environment, Pa	300…110000
Computational complex weight, g	25
Computational complex dimensions (width * length * height), mm	25*63*22

At this stage, the complex completely solves all the tasks, but continuous work is carried out to reduce the measurement errors and increase the reliability and functionality of the complex. The developed on-board measuring complex

is the first stage of development of the instrument cluster of the rocket model launched at a height of up to 100,000 m.

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