*Секция: Технические науки*

**САВЧЕНКО АНТОН МИХАЙЛОВИЧ**
*студент кафедры летательных аппаратов*
*Институт космической техники*
*Сибирский государственный университет науки и технологий*
*имени академика М. Ф. Решетнева*
*г. Красноярск, Россия*
**КРАВЧУНОВСКИЙ АНТОН ПАВЛОВИЧ**
*студент кафедры летательных аппаратов*
*Институт космической техники*
*Сибирский государственный университет науки и технологий*
*имени академика М. Ф. Решетнева*
*г. Красноярск, Россия*
**БЫСТРОВ ДМИТРИЙ ИГОРЕВИЧ**
*студент кафедры летательных аппаратов*
*Институт космической техники*
*Сибирский государственный университет науки и технологий*
*имени академика М. Ф. Решетнева*
*г. Красноярск, Россия*
**ОРЛИН ПАВЕЛ АЛЕКСЕЕВИЧ**
*студент кафедры летательных аппаратов*
*Институт космической техники*
*Сибирский государственный университет науки и технологий*
*имени академика М. Ф. Решетнева*
*г. Красноярск, Россия*
**ТИХОНЕНКО ЕКАТЕРИНА СЕРГЕЕВНА**
*студент кафедры летательных аппаратов*
*Институт космической техники*
*Сибирский государственный университет науки и технологий*
*имени академика М. Ф. Решетнева*

*г. Красноярск, Россия*

**ГАВРИЛЕНКО ИВАН ИГОРЕВИЧ**

*студент кафедры летательных аппаратов*

*Институт космической техники*

*Сибирский государственный университет науки и технологий*

*имени академика М. Ф. Решетнева*

*г. Красноярск, Россия*

**КАРЧАВА ОЛЬГА ВИТАЛЬЕВНА**

*старший преподаватель иностранных языков*

*Сибирский государственный университет науки и технологий*

*имени академика М. Ф. Решетнева*

*г. Красноярск, Россия*

## CONSTRUCTION OF THE LAUNCH PAD FOR MODEL ROCKETS

*The article deals with the rationale for the research of the starting part of the trajectory of flight of model rockets. The device for controlling some parameters at the launch site of the flight path is proposed.*

***Keywords:*** *model rockets, launching pad, slideways.*

The starting distance of the boost phase of the rocket has to provide a sturdy upright positioning of the rocket in order to achieve the needed altitude. In a rocket model a vertical element of boost phase is the most significant part of the whole flight particularly in providing the audience appeal of the demonstrative launch. A launch pad is used for an effective launch of the rocket. It is designed to provide a sturdy positioning, while the rocket model engine generates thrust and sets the right directive.

The appliance of the launch pad is essential, because the boost leg of the rocket is an important part of the flight, while initial velocity is small and the

stabilizing force has a little impact on the flying mode. Any destabilizations while launching can lead to serious positional deviations. [1, p. 104; 157-167]

In most cases a launch pad consists of the basement firmly set up and the rail guides that adjust the rocket positioning on takeoff and vectors the future trajectory. A centering ring is used for the rocket to prevent distortions. Taking into consideration the fact that the ring is fixed outside the cylindrical body tube (in case of the bigger size of rocket, 2 and more rings are possible), the ring violates the shape of the whole rocket and influences some aerodynamic characteristics, such as: head resistance, center-of-gravity and pressure point positions, which, therefore, can change the flight path and significantly increase angular deviation from the pre-determined vector. Also, while mounting centering ring to the rocket, there is a possibility of distortion, which can lead to the rocket locking to the rail guides.

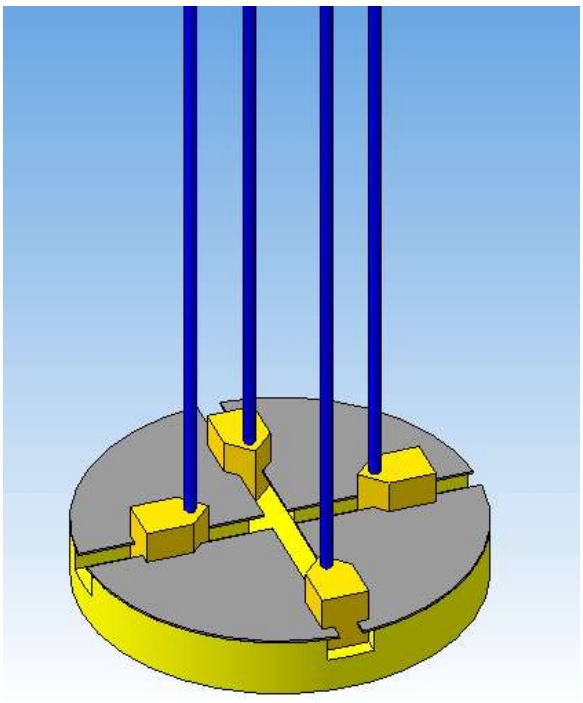

fig. 1. 3D-model of the launch pad

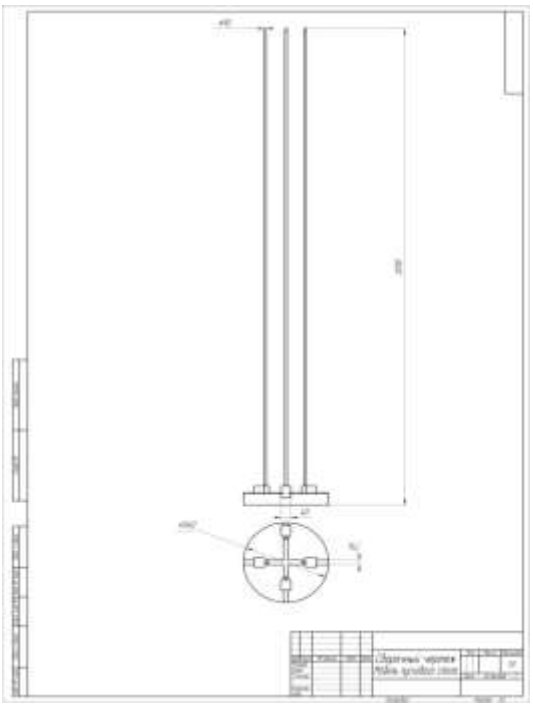

fig. 2. Assembly drawing

The featured model of the launch pad (fig. 1-2) allows avoiding the system of the ring and rail guides and has a form of the rail guides (in this particular case, 4 pieces) that upset the model of the rocket under 90 degrees.

Using such a construction, rail guides become easily adjustable to any diameter of the rocket (except for the maximal diameter that this model allows – 300 mm). Such a form of sliding members allows getting an irreducible diameter of the rocket (20 mm) and also provides the steadiness of rail guides that leads to minimal deviations from the center line of rocket. The material of sliding members and the bottom part of the launch pad is wood. The product can be easily worked at and adjusted. The upper part of the launch pad is made of steel to provide the stiffness of construction and minimize deviations of sliding members at the angle of incidence under the weight of therail guides. Moreover, it prevents the bottom part of the launch pad from the burnout caused by the race of gases coming out from the blast pipe of the rocket engine model. Aluminium is used for the rail guides to provide lesser friction on the body of the rocket and to apply less weight which is particularly important if the rail guides are rather long (2000 mm). [2, p. 79-81]

So, the steadiness of the rocket is guaranteed until it achieves the speed needed for the stabilizing force to appear. While the friction of the rail guides gives time to the rocket engine to generate thrust.

Test runs demonstrate that the necessary upsetting of the rocket can be easily achieved manually. A portative construction of the launch pad simplifies the transportation to a testing area and requires minimal time to assemble and adjust the rail guides to a certain size according to the model of the rocket. A massive table board stabilizes a rocket on takeoff and damps the vibrations of rocket engine which provides a direct launch way of the rocket. [3, p. 22]

In prospect the system of simultaneous operation of sliding members is being worked out. The system allows regulating the power of the pressing of rocket model with torque driver and finding an optimal frictional force to switch the engine to the typical operation. Also, there is a system of orientation of the work table's surface based on Hooke joint to provide balancing of the rail guides, not depending on the surface that is set upon the basement of the table.

**References:**

1. Elshtein P. *Construktoru modelei raket* [To designer of the missiles models]. - Moscow: Mir, 1978, 168 p. (In Russ.).
2. Dumenek V.L. *Modeli raket* [Rocket models]. – Ozersk, 2015, p. 102.
3. N.A. Testoedov, V.V. Kolga, L.A. Semenova. *Proektirovanie i konstruirovanie ballisticheskih raket i raket nositelei*: *uchebnoe posobie* [Ballistic rockets and carrier rockets engineering and designing (On the recommendation of the UMO of the Russian Federation)]. - Krasnoyarsk: SibSAU, 2014, 308 p. (In Russ.).