accuracy for military implication, with a precision of ~100 meters, and ~10 meters, respectively. GPS satellites are located in six planes while GLONASS satellites in turn are located in three planes and at a reduced height. The error of the Russian navigation system without the use of ground stations is about fifty meters while using GPS the error can amount to five hundred meters. This difference is an advantage of GLONASSA. This approach enables to determine the geographic location of an object more accurately, without requiring any additional adjustments.

We considered not all existing navigation systems. In addition to the GPS and GLONASS, developed by Japanese Quasi-Zenith, there is the European Galileo. China and India have also begun to develop their own satellite navigation systems.

The GLONASS market in Russia is only beginning to take shape. But now it is clear that this is a very important and promising component of the economy. The demand for navigation devices that support the GLONASS, is gaining momentum, both in Russia and abroad.

Satellite navigation systems are no longer serve the military purposes, they gradually penetrate in everyday life. More and more devices are equipped with navigation functions ranging from phones to digital cameras.

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Mars Colonization Problems

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Nowadays science and technique are developing very fast, that makes possible the exploration of space and new planets.Now days Mars, the 4th planet of Solar system, is considered as the most perspective planet to explore and colonization. First of all, because this planet has suitable climatic conditions and water supplies.

Some Mars characteristics:

- Mass – 6.4185×1023 kg;
- Volume –1.6318×1011 km
- Surface gravity –3.711 m/s²
- Sidereal rotation period –24h 37m 22s
- Axial tilt –25.19°
- Surface temp –from −143 °C to 35 °C
- Atmospherepressure – 0.636 (0.4–0.87) kPa
- Composition of atmosphere by volume [1]:
  - 95.32% carbon dioxide
  - 2.7% nitrogen
  - 1.6% argon
  - 0.13% oxygen

- 0.07% carbon monoxide
- 0.03% water vapor
- trace of neon, krypton, xenon, ozone, methane.

For the first time ideas about the unmanned mission to Mars had been proposed in the middle of the 20th century by the USSR and the USA.Butthey weren't realized for technical reasons.

Some projects of remote research of Mars are now realized.Thereare some projects, such as NASA's space satellite "Mars Odyssey"; space exploration mission of European Space Agency, named "Mars Express"; Indian automatic interplanetary station "Manglyaan" and two Mars rovers of USA – Opportunity and Curiosity.

The most famous apparatus, working on the Mars, is a Curiosity rover. It has been working on the planet's surface from the 6th of October 2012. Main objectives of its mission are [2]:

(1) todetermine the nature and inventory of organic carbon compounds;

(2) to investigate the chemical building blocks of life (carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur)

(3) to identify features that may represent the effects of biological processes (biosignatures);

(4) to investigate the chemical, isotopic, and mineralogical composition of the Martian surface and near-surface geological materials;

(5) to interpret the processes that have formed and modified rocks and soils;

(6)to assess long-timescale Martian atmospheric evolution processes;

(7) to determine present state, distribution, and cycling of water and carbon dioxide;

(8) to characterize the broad spectrum of surface radiation, including galactic radiation, cosmic radiation, solar proton events and secondary neutrons.

In the nearest future humanity planes sending the manned mission to Mars. Now days there are several projects to realize it. The most famous projectsareMars One and Inspiration Mars Foundation.

Mars One is a not-for-profit foundation that will establish a permanent human settlement on Mars. Human settlement on Mars is possible today with existing technologies. Mars One's mission plan integrates components that are well tested and readily available from industry leaders worldwide. The first footprint on Mars and lives of the crew thereon will captivate and inspire generations; it is this public interest that will help finance this human mission to Mars.

The Mars One mission plan consists of cargo missions and unmanned preparation of a habitable settlement, followed by human landings. In the coming years, a demonstration mission, communication satellites, two rovers and several cargo missions will be sent to Mars. These missions will set up the outpost where the human crew will live and work.

The mission design takes into account the expansion of the human colony where a new crew will arrive every two years.

Mars One will select and train the human crew for permanent settlement. The search for astronauts began in April 2013. More than 200,000 registered for the first selection program.

Stitching Mars One is a Dutch non-for-profit foundation. It is the mother company of Interplanetary Media Group, a for-profit company, which enables the foundation to secure funds from its investors [3].

The Inspiration Mars Foundation believes in the exploration of space as a catalyst for growth and knowledge.

The beauty of this mission is its simplicity. The flyby architecture lowers risk, with no critical propulsive maneuvers, no entry into the Mars atmosphere, and no rendezvous and docking. It also represents the shortest duration roundtrip mission to Mars. The 2018 launch opportunity coincides with the 11-year solar minimum providing the lowest solar radiation exposure. The next launch opportunity for this mission (2031) will not have the advantage of being at the solar minimum.

There are risks associated with the mission, as is true of every space exploration mission. The risks and challenges are well within the scope of experience and can be overcome to achieve a safe and successful mission. In fact, studies by experts have found that the technology and systems are viable with proper integration, testing and preparation for flight [4].

However there are many problems of realization of these projects.

The first problem is lack of a suitable carrier rocket to send the manned spaceship to Mars. According to NASA, it costs$10,000 to send a single pound of payload into space. However, the space agency is working on next-generation launch vehicles to be ready for long-term space travel by 2025, and they hope these new vehicles will reduce the price tag down to $100 per pound. Helping push this goal forward is SpaceX's attempts to make rockets reusable, which would save the hundreds of millions of dollars it costs to build a new rocket for every space-bound launch. In addition to the cost, there isthe time it takesto send anything to Mars to consider. On average, Earth and Mars are 140 million miles apart. The fastest spacecraft NASA ever launched, the New Horizons mission, left Earth in 2006 traveling through space at 36,000 miles per hour. At that pace, it would take a spacecraft 162 days, 5.5 months, to travel 140 million miles [5].

The second problem is an insufficient quantity of data about effects of radiation on the human organism. Currently, manned space flights currently performed within the magnetic belts of the Earth. This factor does not allow scientists to determine, what happens with people during the flight to Mars.

As the scientists know, members of crew of the International Space Station takes 1 milisievert every day [6]. It is equivalently to the dose of radiation, which received by the people for the year. It causesthe risk of malignant tumors and weakened immunity. Weakened immunity of cosmonauts can contribute to the spread of infectious diseases between the members of crew.

According to data obtained from American rover "Curiosity", the level of ionizing radiation during the flight from Earth to Mars is about 1.8 sievert per day [2].

Using this data we can assume that if no protection against radiation will be used, cosmonauts during the flight to Mars will take huge radiation dose, which can cause acute radiation syndrome. This will lead to the death of the crew and the failure of the mission without a professional medical help.

It is necessary to use radiation protection order to prevent this. This protection can be realized by using the antiradiation shields, which can reflect or absorb the ionizing particles.

This method currently has significant drawbacks that hinder their realization. Mass of shields, which can protect a spacecraft from ionizing radiation, is very large. It will increase the mass of the spacecraft. [7] Active research of this problem is currently underway.

The third problem is a Mars harsh climate and high radiation level. To create a permanent colony on the Mars, it is necessary to build a high tech base station. To do that it is necessary to develop and send to Mars a lot of automatic construction and engineering equipment. This task is very complicated and expensive.

Thus, now day’s colonization of Mars is a very complex task with some problems without the effective solutions.

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Antifriction Materials in Aerospace Instrument Making

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Rocket and space technique is very complex. There are many new and difficult problems in the process of space technique design which lead to emergence of the original structures and unusual technical solutions. Many of modern original inventions firstly were used in aerospace engineering, and then in everyday life.

One of the science tasks had to solve is spacecraft energy consumption reducing, heat losses and instruments and equipment durability increasing on spacecraft board.

Life-limiting parameters of aerospace systems include friction and wear in various devices along with extreme operating conditions including humidity variations with altitude changes and broad temperature ranges. Mechanical and endurance requirements of aerospace applications dictate new wear-reduction technologies demanding new materials and advanced technologies. Friction and wear requirements in aerospace systems are dictated by life limiting problems. One challenge is the broad range of contact stresses and sliding speeds for various movable devices. Another challenge is the extreme operation conditions; in particular an aircraft suffers periodical humidity changes depending on the altitude, broad temperature range, and abrasive wear by electrostatically attracted dust [1].

The solution of this problem was using antifriction materials in aerospace instrument making.

Antifriction materials are materials which operate with sliding friction and which under certain conditions have a low coefficient of friction. They are notable for low adhesion, good wear in, thermal conductivity, and stable characteristics. Under hydrodynamic lubrication conditions when are completely separated by a relatively thick layer of lubricant, the properties of the material from which the parts are made has no effect on the friction. The antifriction capability of materials becomes apparent under imperfect lubrication conditions and is a function of the physical and chemical properties of the material, including high thermal conductivity and heat capacity, the ability to form strong boundary layers that reduce friction, and the capability of being easily deformed or worn away so that the load can be uniformly distributed over the contacting surface. Also related to the antifriction capability are the microstructure of the surface and the ability of the material to “absorb” solid abrasion particles that fall on the friction surface, thereby protecting the associated part from wear. Antifriction capability is displayed under dry friction conditions by a material containing components that have a lubricating action and make for low friction by being present on the friction surface [2].

Antifriction materials are divided into metallic and nonmetallic types. The metallic bearing materials include alloys based on tin, lead, copper, zinc, aluminum, and also some cast irons [3,4].

The greatest single advance in the development of improved antifriction materials took place in 1839, when I. Babbitt obtained a United States patent for a bearing metal with a special alloy. This alloy, largely tin, contained small amounts of antimony, copper, and lead. This and similar materials have made excellent bearings. They have a silvery appearance and are generally described as white metals or as Babbitt metals [5]. Babbitt metal is most commonly used as a thin surface layer in a complex, multi-metal structure, but its original use was as a cast-in-place bulk bearing material. Babbitt metal is characterized by its resistance to galling. Babbitt metal is soft and easily damaged, which suggests that it might be unsuitable for a bearing surface. However, its structure is made up of small hard crystals dispersed in a softer metal, which makes it a metal matrix