Conclusion

Flywheel 3D model which meets qualifying standards has been designed. As the 3D model of a flywheel is parametrical, the model completely reconstructs while flywheel changing of external radius. At once there is a recalculation of the parameters depending on the geometrical dimensions of a flywheel, in particular, of internal radius [2]. Application of modern computer design aids allows to project quickly and effectively elements of spacecrafts designs. Parametrization helps to carry out search of a flywheel optimum design with the best strength characteristics.

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DEVICE FOR CONTINUOUSLY MONITORING OF HEALTH OF COSMONAUTS

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УСТРОЙСТВО ДЛЯ НЕПРЕРЫВНОГО МОНИТОРИНГА ЗДОРОВЬЯ КОСМОНАВТОВ

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Cardiovascular disease can appear even absolutely healthy people. Particularly at risk are the cosmonauts, as a long stay in space has a negative effect on the heart. To prevent the occurrence of cardiovascular disease need to detect disease in the early stages, for which require constant monitoring. The article is devoted to the study of devices for the diagnosis of heart disease during the period of cosmonauts on the space station. Were studied devices that use American astronauts during training on Earth and in space. Research has shown that such devices are popular abroad, particularly in the US, but in Russia these analogues are used only in earthly conditions. On the basis of the information received has been offered the idea of a portable cardiograph, which can be used regularly in weightlessness.

Сердечно-сосудистые заболевания могут возникать даже у абсолютно здоровых людей. Особому риску подвержены космонавты, так как долгое пребывание в космическом пространстве отрицательно сказывается на сердце. Чтобы предотвратить возникновение сердечно-сосудистых заболеваний нужно отследить болезни на ранних стадиях, для чего требуется постоянный мониторинг. Статья посвящена изучению устройств, для диагностики сердечных заболеваний космонавтов в период нахождения на космической станции. Были изучены устройства, которые используют американские космонавты во время тренировок на Земле, а также уже непосредственно в космосе. Исследование показало, что подобные

устройства распространены за рубежом, в частности в США, но в России подобные аналоги используются только в земных условиях. На основе полученной информации был предложен вариант создания портативного кардиографа, который можно использовать регулярно в условиях невесомости.

Everyone has seen on TV cosmonauts on the space station, as they live in weightlessness. Most cosmonauts feel well while being on orbit, but only because they receive extensive training before they are sent into space. Cosmonauts can become human beings who have good health, without any diseases and pathologies. But disease can be raised on the board. Due to long-term living in weightlessness the mass of circulating blood is decreasing and blood pressure in the head is keeping constantly high at the same time. All these can cause heart disease. Cosmonauts can have serious health problems after arrival to Earth. For example, one of the crew members of «Soyuz-9" after returning to Earth suffered from two heart attacks [1].

There is the necessary medical equipment on the station. But what if health problems arise during sleep, or when a cosmonaut is in open space. One of the problem solving is the constant monitoring of some health indicators of cosmonauts, such as: pressure monitoring, heart rate and ECG. These indicators are sufficient for detecting early heart disease.

NASA (National Aeronautics and Space Administration) uses such devices for many years. That's look at Keeping the Beat (Figure 1) [2]. This is a special monitor to track heart rate, developed by NASA research center. Continuous monitoring allows doctors to find out the effect of weightlessness on the heart over time. Device technology is quite simple; it is an advanced portable electrocardiograph, which uses ordinary medical electrodes.

Fig. 1. Keeping the Beat

On the space station there is the mini server, which records electrocardiogram in real time over the Internet and transmits to Earth, where a cardiologist views all data. Experiments have shown that the device works well in low gravity and can be used both on Earth and in space.

Another positive feature of this device is that doctors can carry out continuous monitoring of cosmonauts before sending to the orbit, so long as the cosmonauts are training, doctors will be able to determine whether the long-term mission will affect the heart or not.

Similar development of NASA's is 12-channel ECG monitor in the form of a vest (Figure 2) – NimbleHeart [3, 4].

Fig. 2. Nimble Heart

This design allows cosmonauts to carry the device daily. The device is based on dry electrodes [5], which are devoid of the disadvantages, which have ordinary medical electrodes. There is no need prepare the skin, lubricate the electrodes, hair, body temperature or humidity, too, does not prevent to take readings.

Nimble Heart prototype was tested, patients feel comfortable and safe throughout the test. Electrodes cannot prevent a person to make active actions, and it does not affect the readings.

Most portable cardiographs can be used not only on Earth, but in space too. Such a portable cardiograph developed a small innovative company «Potential» (Fig.3) [6]. Design features of the device and algorithms of signal reading allow using the device in weightlessness [7]. But for correctly working need to improve the reliability and fail-safety of the device.

This problem is solving, it requires duplicate the functions of the software, if by any chance the device will be damaged.

Fig. 3 Portable cardiograph by «Potential»

The addition of these modifications allows using a portable electrocardiograph in space. Nevertheless, this device is not a class of continuous monitoring devices. Therefore, the best solution would be the development of devices for continuous ECG monitoring. A distinctive feature of the device is that the capacitive electrodes are used instead of conventional medical electrodes [8]. Such electrodes are less susceptible to external influences and interferences. The devices planned to carry on the shoulder; it is look as a heart rate monitor, which to carry on the shoulder. The signal from the shoulder better than the wrist. Also, if the installed in device a pulse oximeters, it is possible besides the ECG and a pulse to receive data about the blood pressure. It will be recorded all the necessary

information about the heart health of cosmonauts. Data from the device will be transmitted wirelessly and doctors can see the indications of health of cosmonauts. The use of lithium-polymer batteries allow to use the device for several days without recharging.

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COLONIZATION OF PLANETS BY HUMANITY: MYTH OR REALLY?

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КОЛОНИЗАЦИЯ ПЛАНЕТЫ ЛЮДЬМИ: МИФ ИЛИ РЕАЛЬНОСТЬ?

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The humanity seeks for conquering a galaxy. Colonization of other planet will be one of the biggest step to space exploration. The humanity have managed a lot of achievements in the space exploration sphere in short period of time. Many researches of space have been realized. Many planets have been explored for determination of