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INTERNATIONAL SPACE STATION BENEFITS FOR HUMANITY

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ABSTRACT

The International Space Station (ISS) is a scientific station that affords researchers from all over the world to put their talents to work on innovative experiments. The ISS serves as a microgravity and space environment research laboratory in which crew members conduct experiments in biology, physics, astronomy, meteorology, and other fields. The station is suited for the testing of spacecraft systems and equipment required for missions to the Moon and Mars. In the areas of human health, innovative technology, education and observations of Earth from space, there are already demonstrated benefits to people back on Earth. Lives have been saved, station-generated images assist with disaster relief, new materials improve products, and education programs inspire future scientists, engineers and space explorers. Although each space station partner has distinct agency objectives for station research, each partner shares a collective goal to extend the resulting knowledge for the betterment of humanity.

Key words: International Space Station, benefits, space, astronauts.

Introduction

The International Space Station (ISS) is the largest artificial satellite in orbit on Earth, it is a unique scientific laboratory, several nations work for the construction and use the space station. The space station consists of pieces that have been assembled in space by astronauts, it orbits the Earth at an average altitude of 400 km, which means it orbits the Earth every 90 minutes. This space station is used to learn more about life in space, these researches will make it possible to send people further into space than ever before. The space station has made possible the continuous presence of astronaut in space, the astronauts live in space since the arrival of the first crew (2001).

Fig. 1 - Astronauts in extra-vehicular activities

The International realization illustrates the teamwork needed to create an international partnership that has continued to develop and serve as a model for international cooperation. Although each partner of the space station has a distinct research objective, the unified purpose is to expand the knowledge accumulated to benefit all humanity. The International Space Station is a laboratory for performing investigations that affect human health both in space and on Earth. During its period in orbit, of several aspects of human health, including aging, disease and environmental impact. Driven by the need to support astronaut health, several human biological and physiological investigations have yielded important results that can benefit us on Earth. The biologist has used ISS laboratory modules to study the response of the human body to extended periods of microgravity, and also development, life cycle and behavior of micro-organisms, plants and animals and how they are influenced by space radiation.

Space station laboratories allow crew members to do research that could not be done anywhere else, this scientific research benefits the people of Earth. Scientists study what happens with the body when people live in microgravity for a long time. All of these lessons will be important for the future on an exploration plan for other worlds.

Supporting water purification efforts worldwide

In space or in the life on Earth, clean water is essential for living organisms. The test methods developed to ensure water quality on the International Space Station has led to monitoring

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advancements here on Earth. Efficient wastewater recycling from ISS reduces the need to supply resources.

Without this ability, filtering water on board the space station would not support six crew members and supply is not an option for long-term space travel. The Space Station's Environmental Control and Life Support System (ECLSS) recovers wastewater from fuel cells of the station. Without such careful recycling, 40.000 liters of water per year from Earth would be required to resupply a minimum of four crewmembers for the life of the station. Unfortunately, many people around the world don't have access to clean water. Using the technology using for the space station the risk areas can access advanced water filtration, which makes a difference in saving lives in these communities. The collaborations between organizations and NASA show how efficiently space research can adapt to contribute the answer to this global problem. The Water Security Corporation, in collaboration with other organizations, has implemented a system that uses NASA's water processing technology. The first system using NASA technology was installed in northern Iraq in 2006.

Fig. 2 – ISS 19 Crew members drink water from the Water Recovery System

Preventing bone loss

In the early days of the space station, astronauts were losing about one and a half percent of their total bone mass density per month. Scientists have found that high-intensity exercise, dietary supplementation with vitamin D can remedy this. This research is also applicable to vulnerable populations on Earth. The common problem of bone loss in the elderly is also observed at astronauts when they are in space. Crew members engage in physical exercise for 2.5 hours a day, six times a week (15 hours a week). However, the risks of these problems occurring cannot be eliminated through physical exercise alone. Bisphosphonate is a therapeutic agent that has been used to treat osteoporosis patients for more than a decade, with proven efficacy to increase bone mass and decrease the occurrence of bone fracture. Through 90 day bed rest research on Earth, it was confirmed that this agent has a preventive effect on the loss of bone mass.

Protein crystals in Microgravity

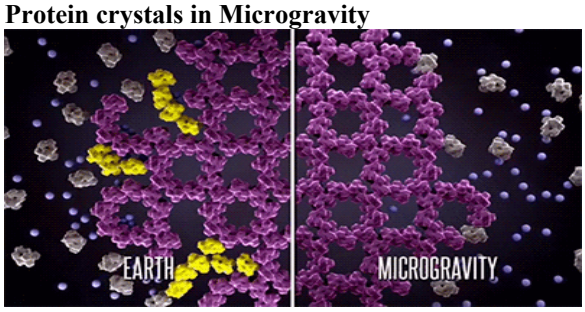

Fig. 3 - The difference between protein crystals grown on Earth versus in microgravity

The growth of protein crystals for medicine is an essential challenge in developing effective treatments and in knowing the shape of protein molecules in the human body. The unique microgravity environment of ISS allows the growth of higher quality protein crystals than those that can be grown on the ground. Proteins are responsible for several biological functions, including DNA multiplication but also digestion. Thus, protein crystallography is an essential tool for understanding these structures. The growth of crystals in a fluid on Earth is constrained by the convection movements caused by gravity and the precipitation of denser particles on the bottom of the fluid vessel. In microgravity, crystals can be larger than on Earth, allowing a simpler analysis of microstructure. Protein crystals developed on ISS are used in the development of new drugs for diseases such as cancer or muscular dystrophy, research that benefits from ISS are the growth of protein crystals. The unique microgravity environment of ISS allows the growth of higher quality protein crystals than those that can be grown on the ground. Studying the structure of proteins in the human body leads to the development of medical treatments.

Microgravity allows unique conditions for the growth of protein crystals where there is no gravity or convection to disrupt their growth. The protein expressed in certain muscle fibers of patients with Duchenne Muscular Dystrophy, which affects 1 in 3,500 boys, has been successfully crystallized in space revealing a new inhibitor several hundred times stronger than the prototype inhibitor.

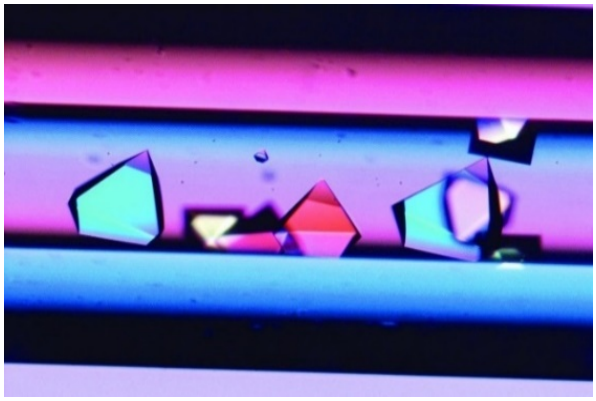

Fig. 4 - Protein crystals formed in microgravity

Monitoring natural disasters from space

The tool on the Space Station captured photos of Earth from space for fixation in countries during development affected by natural disasters. A wider collective experiment by NASA and the US Agency for International Development, known as SERVIR, worked with nations in the process of transforming the world to use satellites for decision making. Images from orbit made rapid response efforts to floods, fires, volcanic eruptions, deforestation, damaging blooms and other types of natural events. As a result of the plague, 90% of the areas populated on Earth every 24 hours, ISERV provided an availability to be able to imagine during devoting, collecting up to 1,000 images per day. For example, on March 13, 2011, the crew at the International Space Station responded in real-time to the crisis on the east coast of Japan, which was rocked by the magnitude 9.0 Tohoku earthquake, one of the strongest ever recorded, and which gave birth to a tsunami that flooded much of Honshu Island. The images provided by ISS illustrated two unique aspects of the earth monitoring and disaster response station. Using digital cameras, the crew can capture sunlight on water surfaces with greater frequency and control than most satellite systems, which means an improved ability to detect and map standing water and indicate areas of water interest in the contamination of the environment and health.

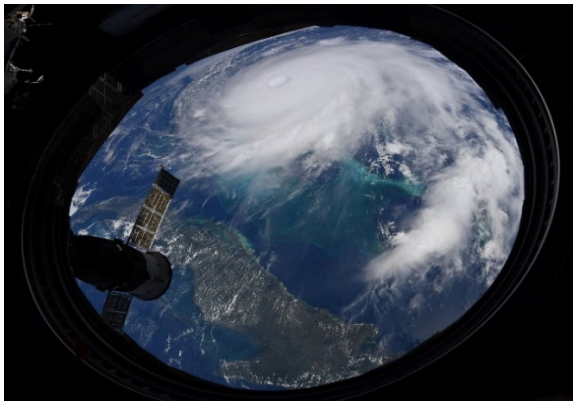

Fig. 5 - Hurricane Dorian saw from aboard the Space Station

Providing students opportunities to conduct their science in space

Since the launch of the first modules of the International Space Station (ISS) into orbit, students have been provided with a unique opportunity to get involved and participate in science and engineering projects. Many of these projects support inquiry-based learning, an approach to science education that allows students to ask questions, develop hypothesis-derived experiments, obtain supporting evidence, analyze data, and identify solutions or explanations. This approach to learning is well-published as one of the most effective ways in which to engage and influence students to pursue careers in science and technology fields. The International Space Station has a unique ability to capture the imaginations of both students and teachers worldwide. The presence of humans aboard the space station provides a foundation for numerous educational activities aimed at piquing interest and motivating children toward the study of science, technology, engineering and, mathematics. Projects such as the Amateur Radio on International Space Station, Asian Try Zero-G, and Synchronized Position Hold, Engage, Reorient Experimental Satellites Zero Robotics competition, among others, have allowed for the global student, teacher and public access to space through student image acquisition and radio contacts with crew members. Projects such as these and their accompanying educational materials are distributed to students around the world. Through the continued use of the space station, we will challenge and inspire the next generation of scientists, engineers, writers, artists and explorers.

Quickly Diagnose instruments for the Space Program

The ability to quickly diagnose an illness or injury and initiate treatment improves the outcome for the patient and reduces the consequences for the rest of the mission. For astronauts in orbit about 400 km above the Earth, on the International Space Station, this problem was addressed by the Advanced Diagnostic Ultrasound in Microgravity (ADUM) experiment. In partnership with the World Network, focused on ultrasound, ADUM's principal investigator, techniques originally developed for astronauts of the space station and adapting them to be used in the most distant corners of the Earth by developing protocols for performing complex procedures with remote guidance and training of experts. Health care has become more accessible in isolate regions through the use of small ultrasound units, and remote guidance techniques, like those used for people living onboard the space station.

Fig. 6 - Using the ADUM protocols, ISS Expedition Commander Leroy Chiao performs an ultrasound examination of the eye on Flight Engineer

Providing medical care for people in retired communities, such as Antarctic stations and on isolated crews, such as the International Space Station crew, is particularly challenging. Medical care at these isolate locations is usually performed by minimally trained medical personnel, and a physician is sometimes available only through phone. The ability to quickly diagnose an illness or injury and initiate treatment improves the outcome for the patient and reduces the consequences for the rest of the mission. The ability to make an accurate diagnosis in isolate areas reduces the impact of the incident and the chances of an expensive and potentially dangerous and unnecessary evacuation. Ultrasound imaging is among the fastest, safest and most universal diagnostic methods ever invented. It provides much of the information that can be obtained by expensive technologies, such as X-ray, computed tomography, or magnetic resonance imagery, and it is the only method to produce a real-time or live image that can be interpreted and transmitted at the same time.

Rezumat

Stația Spațială Internațională (ISS) este o platformă științifică care permite cercetătorilor din întreaga lume să lucreze la experimente inovatoare. ISS este un laborator de cercetare în care membrii echipajului efectuează experimente în biologie, fizică, astronomie, meteorologie și alte domenii. Stația spațială este folosită pentru testarea sistemelor și echipamentelor necesare pentru viitoarele misiuni pe Lună și pe Marte. În domeniile sănătății, tehnologiei, educației există deja beneficii demonstrate pentru oamenii de pe Pământ. Imaginile realizate de către instrumentele stației spațiale ajută la intervenția rapidă în cazul dezastrelor naturale, iar programele de educație inspiră viitorii oameni de știință, ingineri și exploratori spațiali. Deși fiecare partener al stației spațiale are obiective distincte pentru cercetare, fiecare partener are un scop unificat de a extinde rezultatele pentru binele umanității.

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