

NANOTECHNOLOGIES IN SPACE

Altyntsev Ievgenii, *gr.DM-41*,
Zolotova S.G., *EL advisor*

Nanotechnologies are very perspective area for researchers in any country. They can dramatically change all our future life in better way. Nearest years will be most important for all mankind, because nanotech will be input into all areas of peoples life. It will make our life more easier, safe, interesting. Every of us will have more opportunities for making his dreams and hopes real. But the first area which will use and improve the nanotechnologies will be space. This technologies of the future can invert all our imaging about our planet, about solar system, they can give us a possibility to investigate and colonize the nearest planets and make the space around our planet more accessible for any of us.

There are some examples of using nano-products in different future space projects.

Nanotechnology Fueling Rockets.

The space elevator is a device that will dramatically reduce the cost of sending cargo into orbit. Like any elevator the space elevator will have a cable, however it will need to be stronger than any existing cable. Roughly 90,000 kilometers long, the space elevator cable will probably be made from carbon nanotubes. It will be anchored at the top to an asteroid (called the counterweight) in orbit around the earth, and at the bottom by an anchor station, perhaps floating in the ocean similar to a drilling rig.

This device would eliminate the need to use rocket fuel, and dramatically reduce the cost of sending cargo into orbit (about 95% of the weight of the space shuttle at blast off is rocket fuel). Instead, solar cells on space elevator cars would convert light from a laser beam mounted on the anchor station into electricity to drive the car up or down the cable like a vertical monorail.

Setting Sail in Space.

Once you have people and cargo in orbit nanotechnology can be used to reduce the rocket fuel needed to travel to the moon or planets. Just as sailboats are propelled by wind while on the seas, spaceships can be propelled by light from the sun reflected off of solar sails while travelling through space. That means that the only fuel required would be during liftoff, docking, or landing.

However solar sails will have to be very large, spreading for kilometers, and very thin to keep their weight low. That's where nanotechnology enters the picture. Researchers at the University of Texas have used carbon nanotubes to make thin, lightweight sheets that may replace the polymer sheets that have

been experimented with to date. While there are details still to be worked out (such as how to unfurl a thin, fragile sail in orbit, along with the continual struggle to reduce weight) this method has great potential for reducing the amount of fuel needed to travel between planets.

Building Better Engines.

For those times when spacecraft need engines there's a type of engine called ion thrusters that uses less fuel than chemical rockets. Unlike chemical rockets, which push a spaceship by burning fuel and expelling the resulting hot gasses ion thrusters use electricity gathered from solar cells to generate electric fields that push ions away from the spaceship.

How Nanotechnology Can Improve Spaceships.

NASA has included a concept called self healing spaceships in their 2030 nanotechnology roadmap. Just as your skin heals a small puncture wound NASA is looking to nanotechnology to provide a way for the skin and structural components of a spaceship to seal up damage from meteors that strike the spaceship.

NASA is also planning to use nanosensors to improve the monitoring of spaceship systems such as life support. The ability of nanosensors to quickly report changed levels of trace chemicals in air could be very useful to keeping life support systems working correctly in a spaceship's closed system. A longer term proposal is to place nanosensors throughout the skin of a spacecraft to act like nerve endings in your skin. When a particular region of the spacecraft skin becomes is stressed or damaged, the main computer is alerted to take action and alter the spaceship's course, just as you would jerk your hand away from a hot stove.

What the Well Dressed Astronaut Will Wear.

Occasionally astronauts have to leave their spaceships, so researchers at Northeastern University and Rutgers University propose that we protect the astronauts by including layers of bio-nano robots in their spacesuits. The outer layer of bio-nano robots would respond to damages to the spacesuit, for example to seal up punctures. An inner layer of bio-nano robots could respond if the astronaut was in trouble, for example by providing drugs in a medical emergency.

The term bio-nano robots comes As we can see, there are a lot of projects which will change our possibilities of investigating the space. But not oly space, all areas of our life can be changed with such technologies, and they will be changed in nearest future.