

SPACE DEBRIS DESTRUCTOR EQUIPMENT MOUNTED OVER SPACE TELESCOPE WITH AN INTEGRATED IMAGING SYSTEM

PremchandC.P.¹, Rakesh bhattacharjee², Rambabu K.G.³

^{1,2,3} Students, Department of Aeronautical Engineering, PCET, Coimbatore-59.

Contact Details:

E-Mail : prem.tech123@gmail.com

Mobile : +91-9487848158

ABSTRACT

The survey reveals that there had been many major catastrophic effects caused by a space junk to the active satellites. It is predicted that below 2000 km altitude, debris particle of about 19,000 pieces larger than 5 cm are tracked along with another 300,000 pieces smaller than 1 cm.

Major space debris particles are less than 1 cm which includes dust from solid rocket motors, surface degradation products such as paint flakes. Damages can be reduced with a kind of armor type shielding called as the Whipple shield which protects some parts of the spacecraft. But not all the parts like solar panels and optical devices such as telescopes, or star trackers may be protected in this manner. These components are subject to constant wear by debris and micrometeoroids. So, this collision of debris with other space crafts may lead to greater loss.

The Chinese anti-satellite test was one of the debris producing events in 2007. In that controversial test, China destroyed one of its own weather satellites, adding about 3,000 pieces of space junk to the ever-growing debris cloud around Earth.

NASA estimates that this cloud contains 500,000 objects bigger than a marble and 22,000 larger than a softball. The number of flecks of at least 1 millimeter in diameter probably runs into the hundreds of millions.

Keywords: debris, imaging system, armor shield, thrust vectoring, trident laser, nebula, and dwarf stars.

INTRODUCTION

For collecting these kinds of debris particle which are responsible for destruction of satellites, similar mechanism used for docking purpose can be used. The main scope of this paper is to explain the procedure that can be followed to destroy the debris particle after compressing the collected debris into a compact form. This can be achieved by applying equal and opposite forces on all directions which will depend upon the gravitational pull in that particular spatial location. Finally the destruction of the debris particles can be done by using extremely high intensity lasers.

Controlled Thrust-vectoring nuclear propulsion unit can be used to change the orbit of rotation of the entire unit. In order to prevent the harmful effects caused by the

radiation, proper shielding from the radiation needs to be deployed. In order to increase the fuel economy, more number of solar panels can be used as an alternate source of energy. The proposed design of the debris destructor consists of 3 units-grabber, crushing unit and the laser destroyer. The plan is to incorporate this entire scientific device with the telescope.

CONSTRUCTION OF DEBRIS DESTRUCTOR

GRABBER

The tube assembly consists of 5-7 sub tube extensions with 2-4 robotic arms. Total number of joints for the robotic arm is 4 in number which can move in any direction.

By using the appropriate sensing unit, the presence of debris particles in space can be sensed with high accuracy. After sensing, the nuclear propulsion unit will help it to reach as much nearer to the debris particle as possible.

CRUSHING UNIT

It consists a compressor unit which will apply equal and opposite force in all directions. Two of the faces should be able to open and close for the debris to pass through.

The debris can be allowed inside the vehicle by opening one of the faces of the compressor unit. This compressor unit will send off the compressed debris from the opposite face.

DESTRUCTOR UNIT:

The destructor unit has a high intensity lasers like trident lasers which is capable of destroying the debris particles. For the most efficient design the reflecting surface is highly polished. The reflector is surrounded by the absorber which has some grain particles to reduce the intensity of lasers after reflected from the polished surface. A hexagonal reflector mounts 8 laser emitting source placed at each of the edges. One of the faces of hexagonal based pyramid is provided for allowing the compact debris to pass through it. The transformed gaseous state from the debris particle can be used as the source of energy to run the other scientific instruments and some other special instruments in the vehicle.

CONSTRUCTION OF NUCLEAR PROPULSION UNIT

Nuclear propulsion unit consists of a reactor in which nuclear fission reaction takes place. This energy is used for propelling and by applying the thrust vectoring principle, the trajectory of the vehicle can be changed. Harmful radiation produced by the nuclear fission reaction can be trapped by a radioactive shield. Type of the nuclear reactor is based on the type of the construction meant for the vehicle.

CONSTRUCTION OF INTEGRATED IMAGING SYSTEM IN TELESCOPE

Types of imaging system consist of Ultraviolet, Infrared, Visible, X-rays and Gamma rays. All these types of imaging system are embedded into a single system

which can sense according to the incoming signal.

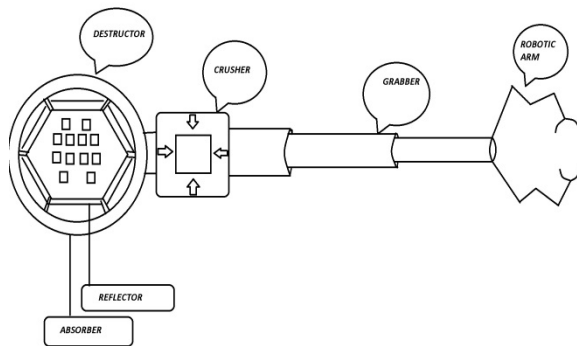


Fig. Space debris destructor equipment

ULTRAVIOLET IMAGING SYSTEM

This type of imaging system analyses the ultraviolet rays which is emitted by the celestial bodies. And by applying certain boundary condition the pressure layer is assumed. Then prediction of the object is done by its twinkling effect, intensity of radiation and also by some other parameters. Ultraviolet imaging system makes observations at ultraviolet wavelengths, i.e. between approximately 10 and 320 nm. Light at these wavelengths is absorbed by the Earth's atmosphere, so observations at these wavelengths must be performed from the upper atmosphere or from space. Objects emitting ultraviolet radiation include the Sun, other stars and galaxies.

VISIBLE IMAGING SYSTEM:

The oldest form of astronomy, optical or visible-light astronomy extends from approximately 400 to 700 nm. Positioning an optical telescope in space means that the telescope does not see any atmospheric effects, providing higher resolution images. Optical telescopes are used to look at stars, galaxies, planetary nebulae and protoplanetary disks, amongst many other things.

INFRARED IMAGING SYSTEM

Infrared light is of lower energy than visible light, hence is emitted by cooler objects. As such, the following can be viewed in the infrared: cool stars, nebulae, and red shifted galaxies. By capturing and analyzing this rays will be useful for finding these kind of cooler objects.

X-RAY IMAGING SYSTEM

X-ray imaging system collect and measure high-energy photons called X-rays. These cannot travel a long distance through the atmosphere, meaning that they can only be observed high in the atmosphere or in space. Several types of astrophysical objects emit X-rays, from galaxy clusters, through black holes in active galactic nuclei to galactic objects such as supernova remnants, stars, and binary stars containing a white dwarf, neutron star or black hole. Some solar system bodies emit X-rays, the most notable being the Moon, although most of the X-ray brightness of the Moon arises from reflected solar X-rays. A combination of many unresolved X-ray sources is thought to produce the observed X-ray background

GAMMA IMAGING SYSTEM:

Gamma ray imaging system collect and measure individual, high energy gamma rays from astrophysical sources. These are absorbed by the atmosphere, requiring that observations are done by high-altitude balloons or space missions. Gamma rays can be generated by supernovae, neutron stars, pulsars and black holes. Gamma ray bursts, with extremely high energies, have also been detected but have yet to be identified

These imaging systems are integrated to a single unit which has a particular Image processing system used to image the celestial bodies with the type of incoming rays emitted from these bodies.

CONCLUSION

In the summary part, the debris particles which cause cataclysmic effects can be vanished by destroying it. This destruction is done by using a high intense ultrasonic laser. The material has to be taken in such a manner which is an advanced type ideology kept for future aspects.

REFERENCES

1. McLean, D. J. & Wild, J. P., Systems for Simultaneous Image Formation with Radio Telescopes published in Australian Journal of Physics, vol. 14, p.489, Bibliographic Code: 1961AuJPh..14..489M
2. Dr. John Rather, prior Assistant Director for Space Technology Program Development at NASA. "Transformational Technologies to Expedite Space Access and

- Development". Retrieved 28 April 2011.
3. David B. Spencer, Charles B. Hogge, W. Spencer Campbell, Marlon E. Sorge, S. Rex Mcwaters , "Some Technical Issues of an Optically Focused Small Space Debris Tracking and Cataloging System" 2000, Volume 2, Issue 3, pp 137-160
4. Doyle T. Hall, Mark J. Matney , "Collision Probabilities for Keplerian Orbits",2000, Volume 2, Issue 3, pp 161-198
5. Proc. SPIE 4115, Applications of Digital Image Processing XXIII, 629 (December 28, 2000); doi:10.1117/12.411584
6. Laser Sensing and Imaging and Applications, 890512 (September 19, 2013); doi:10.1117/12.2033511
7. Huayan Sun ; Yi Han , "Research on space object active detection lidar system imaging simulation" Academy of Equipment Command & Technology (China), International Conference on Space Information Technology 2009, 76510D (April 02, 2010); doi:10.1117/12.855389