

# Strategies and Technological Advances in Removing Space Debris Satellite

S. Philomina, B. Hemalatha, R. Hema

**Abstract:** Now days we are sending many satellites into the space which are mainly useful for communication. Till now we have sent many satellites and we have dropped many things in the space like those dead particles revolves around the earth in Low Earth Particles (LEO). This derbis became a problem. It will be a risk to other particles which are revolving in LEO. If we doesn't take any steps it will lead to collisions and destroy all communication system. The Japan Aerospace Exploration Agency (JAXA) Aerospace Research is studying a micro-satellite space derbi removal scheme. This paper discuss about the Key technologies, strategies and specifications of removing derbis satellite.

**KEY WORDS:** JAXA, Piggyback, EDT, star tracker, stereo vision, LEO, Rendezvous sensors, JEM, JCAP, STEP, Thrusters.

## I. INTRODUCTION

Moon is a natural satellite for earth. Satellites are used for communication purpose. Japan Aerospace Exploration Agency (JAXA) Aerospace Research is studying the removal of derbis from orbit Generally, it comprises of tiny spacecraft (a micro-satellite capable of piggyback launches with other payloads).

Hundreds of millions of space craft are orbiting the earth at a speed of several kilometers per second. Showing that these space craft will become a major issue for the next few years. Generally, the study demonstrates that, if beings do not take any action to regulate the derbis, it leads to the crash of spacecraft. This contributes to the destruction of the Earth's communication scheme. For example, the Global Positioning System (GPS), the navigation signals are the main components of this global economy model. GPS failure will disrupt all emergency reaction facilities, banking systems, and power grids[1],[3],[5]. This satellite will transfer big derbis items that occupy Low Earth orbits to the disposal orbit. Electro-Dynamic Tether (EDT) technique is being tested as a strong orbital transfer scheme for this idea. This EDT scheme is used to deorbitalize the derbi.

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**S. Philomina**, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India. E Mail - philomina.nov83@gmail.com

**B. Hemalatha**, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India. E Mail - contacthemab@gmail.com

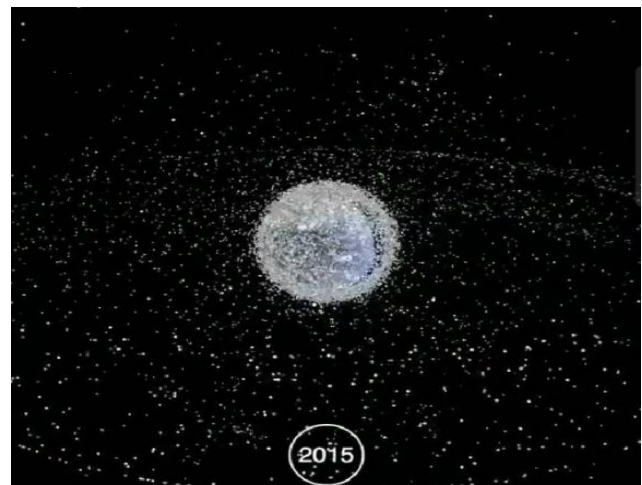
**R. Hema**, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India. E Mail - hemrbujradha@gmail.com

## II. ECONOMICAL SURVEY

Generally, the term space derbis referred for the natural derbis present in the solar system I.e, asteroids, comets and meteoroids. In 1957, Hams Patterson, is the first person founded there is a measurements of the fall of space dust on the, estimating to be 14,30,000 tons per year. After that in 1979, NASA was studying over this, they founded there is space debris in earth's orbit i.e, dead space crafts, rockets. They estimated that if it raises like this it will lead to collisions[2],[4],[6].

As of 5 July 2016, the strategies of the United States tracked almost 17,852 artificial objects in Earth orbit.

Practically, there is 6,800 tons of space derbis in our Earths orbit. Moreover that 23,000 tracked objects and 26,000 untracked (<10cm) objects are present in Earths orbit.



III. METHOD FOR REMOVING SATELLITE DERBIS

Generally speaking, satellites occupy either the Low Earth Orbit or the Geo-Stationary Orbit. Space craft and Rocket upper stages in GSO shall be removed by de-orbitilization at an altitude of up to 650 km or less in 25 years from which they shall re-enter the atmosphere and burn[7],[9],[11].

IV. TARGET FOR RETRIEVAL / REMOVAL

The impact of the Earth's gravitational field is powerful in LEO. So, we can use an electro dynamic tether to produce a thrust to decrease the orbit[8],[10],[12].

Low Earth Orbits are efficient in Earth Observation. (Specially in Sun-Synchronous Orbits) there is a danger of spacecraft collision. In order for measures to be taken to decrease the amount of spacecraft, rockets are in the upper phases of such orbits. In this consideration, JAXA is researching a system with technology of retrival and removal of satllite derbis from low earth orbits.

V. STRATEGY

Many number of satellites remain in ISO and GSO Orbits from past launches and this becomes a derbis in Orbits. This micro satellite will retrive and removed derbis from orbitales. This micro-satellite transfers the derbis to reduced orbits and also removes the object by catching it using a robot arm and then de-orbiting it[13],[15],[17].

The following strategies which are used for removal.

- a. A piggy back launch of the derbi removal will monitor low earth orbit satellites that are helpful for Earth observation.
- b. The use of electrodynamic tethers generates a thrust for reducing the orbit.
- c. The Robot Capture at the other end of the tether. The body of the car itself is the tip mass of the tether.

VI. OPERATIONS

Removing Debris satellites will dock with International Space Station (ISS) which is present in Low Earth Orbit (LEO). It will release a Japanese Experiment module(JEM) This contains four operations.

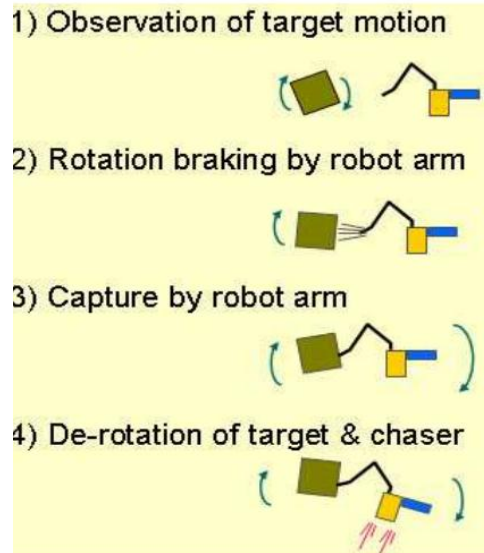
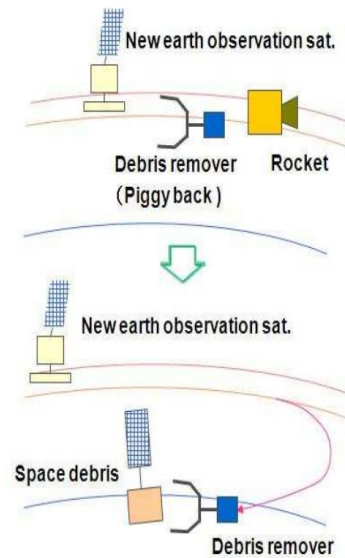
- 1. Net Capture : throwing a net on derbis and De-orbitalise it.
- 2. Vision-based-navigation : Robotic vision will check the status of the derbis.
- 3. Harpoon capture : It is designed to capture the space-junk.
- 4. Drag soil : This soil will drags the derbis to de orbits within eight weeks of deployment

VII. KEY TECHNOLOGIES FOR SDMR

- a. The following main techniques are needed to remove the derbis satellite.
- b. Orbital transfer technology. Navigation around space craft (or) derbis : vision capture/image processing
- c. Robotic Arm Capture : This will capture the derbis object

SPECIFICATIONS OF THE SDMR

Item	Specification	Remarks
Dimensions	700*700*600mm	
Weight	140kg	Fuel:25kg
Power	100w	Average
Attitude control	3-axis control	3 wheels
Thrusters	IN*8	
Rendezvous sensors	GPS receiver Star tracker Stereo vision	



VIII. APPLICATIONS

A. Space applications

This project helps to create spaceflight safer for spacecraft and, in the event of crew members, for individuals on board. Results support future attempts to remove big non-operational spacecraft in order to help avoid the space station from having to dodge debris[14],[16],[18].



## B. EARTH APPLICATIONS

Space debris collisions position essential space-based facilities on Earth at danger, such as navigation and cell phones[19],[20]. Reducing the danger of space crashes prevents these and many other essential facilities.

## IX. CONCLUSION

The JAXA Aerospace Research Directorate is studying an active space debris removal scheme using microsattellites and is exploring the applicability of EDT technology as its high-efficiency orbital transfer scheme. Prototyping and testing of each EDT hardware component is advancing. Although space debris management will pose certain hazards, early investment in maintaining the near-earth space environment is needed to safeguard the satellite technology that is so essential to the day-to-day activities of the global economy. by implementing steps to remove worldwide space debris, There is a critical chance to mitigate and minimize potential harm to space debris and to guarantee the sustainable development of the near-earth space environment.

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## AUTHORS PROFILE



**S. Philomina** Assistant Professor, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, India.



**B. Hemalatha** Assistant Professor, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, India.



**R. Hema** Assistant Professor, Department of Electronics and Communication Engineering, Bharath Institute of Higher Education and Research, Chennai, India.

