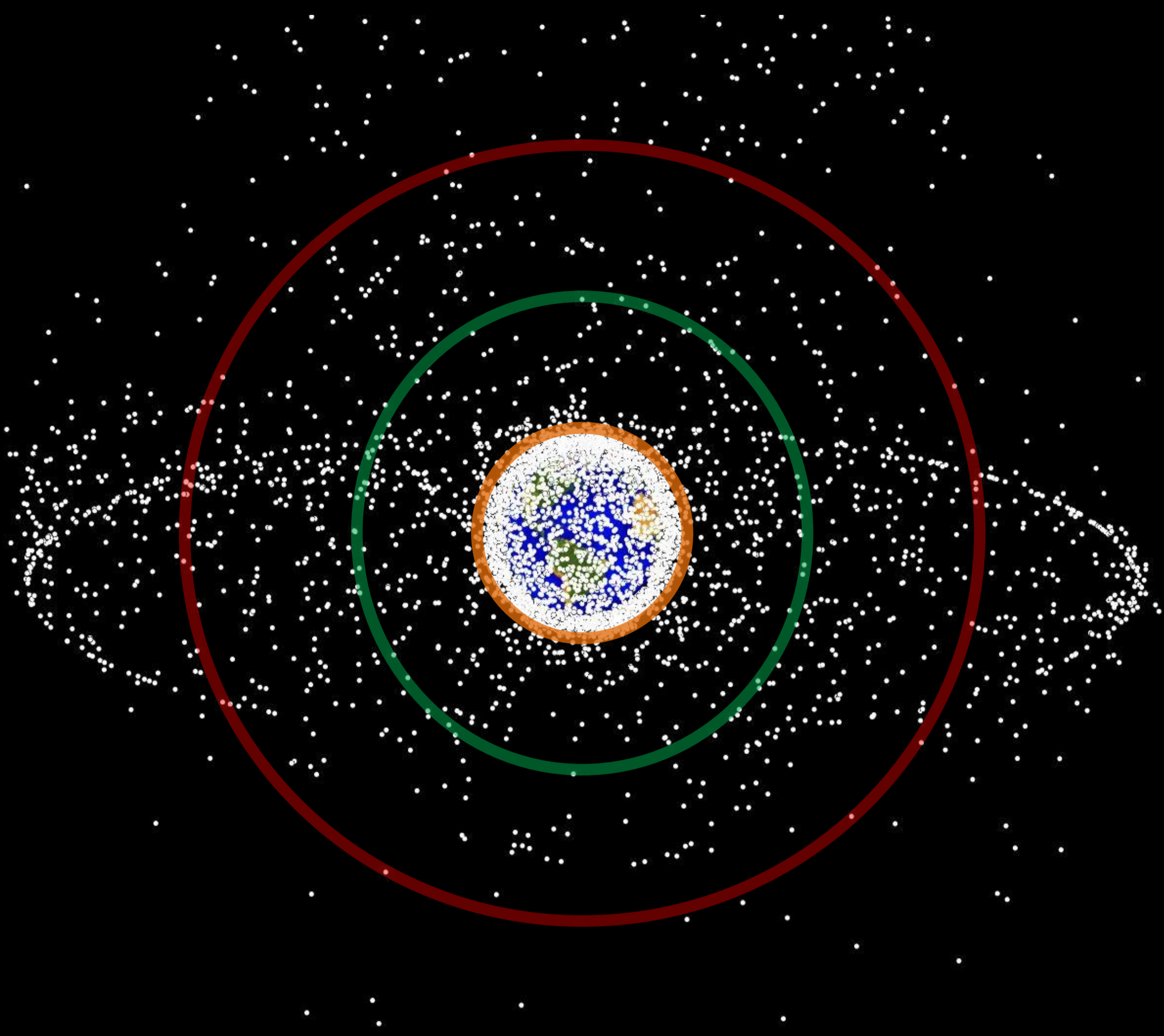# SPACE DEBRIS - RISKS, IMPACTS AND SOLUTIONS.

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SIZE RANGE OF DEBRIS PARTICLES

128 million objects from 1 mm to 1 cm

900 000 objects from 1 cm to 10 cm

34 000 objects >10 cm

SPACE DEBRIS

Space debris has become a growing concern in recent years, These are human-made objects in orbit that no longer serve a useful purpose, including defunct satellites, discarded equipment and rocket stages, and fragments from the breakup of satellites and rocket stages.
Size of debris particles ranges from 10 μm to 10 m. The debris at high altitudes can stay in orbit for decades or longer. Since they have very high speed in orbit (8km/s),
even relatively small pieces of space debris can cause great damages to functional satellites during a collision. Therefore , with the increase in number of satellites in the orbit, the risk of collisions also increases. This in turn affects many satellite applications like navigation services, military applications, and disaster management. In particular, internationally adopted debris mitigation guidelines are reducing the introduction of new fragments into Earth's orbit. However, there is a growing consensus within the space debris community that mitigation is insufficient to constrain the orbiting debris population. Also, in order to ensure a safe future for space activities , the development and deployment of systems will be required to actively remove debris from Earth's orbit.

ORIGIN & FIGURES RELATED TO SPACE DRBRIS

Two worst events generated third of all catalogued orbital debris: destruction of Chinese weather satellite Fengyun-1C by missiles, and the accidental Collison of Iridium 33 (an active US communication satellite) and Kosmos-2251 (defunct Russian satellite) at a speed of 11,700 m/s (26,000 mph; 42,000 km/h) and an altitude of 789 kilometers (490 mi) above the Taymyr Peninsula in Siberia.

Number of rocket launches since the start of the space age in 1957:
About 5450 (excluding failures)

Number of satellites these rocket launches have placed into Earth orbit:
About 8950

Number of these still in space:
About 5000

Total mass of all space objects in Earth orbit:
More than 8400 tones

Number of these still functioning:
About 1950

Number of debris objects regularly tracked by Space Surveillance Networks and maintained in their catalogue:
About 22 300

Estimated number of break-ups, explosions, collisions, or anomalous events resulting in fragmentation:
More than 500

Source : ESA

SOLUTION

This GUI Model shall help us in measuring the impact and risk factors resulting from various types of space debris collisions.
Following are the steps of GUI model :

1.] Select/Enter Orbit.
   LEO (Low Earth Orbit),
   MEO (Medium Earth Orbit),
   GEO (Geosynchronous Orbit).

2.] Select/Enter type of Space Vehicle, type of Satellite, and type of Debris.
   Vehicle Capacity, Fuel details, Satellite's details (Hardware Material, Size), Debris (Size, Material Type)

3.] Select/Enter Direction & Velocity (As per given data or enter manually).

4.] Calculate Probability of Collision, if probability is there then check for impact area and apply manoeuvres.
   here probability of collision is calculated with the help of following parameters
   relative collision velocity, collision cross section area, spatial density of objects, and time.

FUTURE SCOPE

The GUI can be strengthened using relevant and real time data. In future GUI can generate and predict results for impact area, reentry of objects, and probability of collisions with more accuracy using machine learning techniques.
Also GUI can add features like monitor Orbit health using special techniques, which includes monitoring of active satellites and their accurate manoeuvres.

Flowchart of GUI Model

Select Orbit → Vehicle, Satellite, Debris → Direction & Velocity → Calculate Probability of Collision → Yes → Apply manoeuvres / No