D-ORBIT

Solutions for our Future

Spazio senza frontiere:
Un mondo più grande è possibile!
Politecnico di Milano, Campus Bovisa
8-9 Maggio 2014

DECOMMISSIONING: UNA TECNOLOGIA PER LA SOSTENIBILITÀ

D-Orbit

Luca Rossettini, Francesco di Tolle e Alessio Fanfani

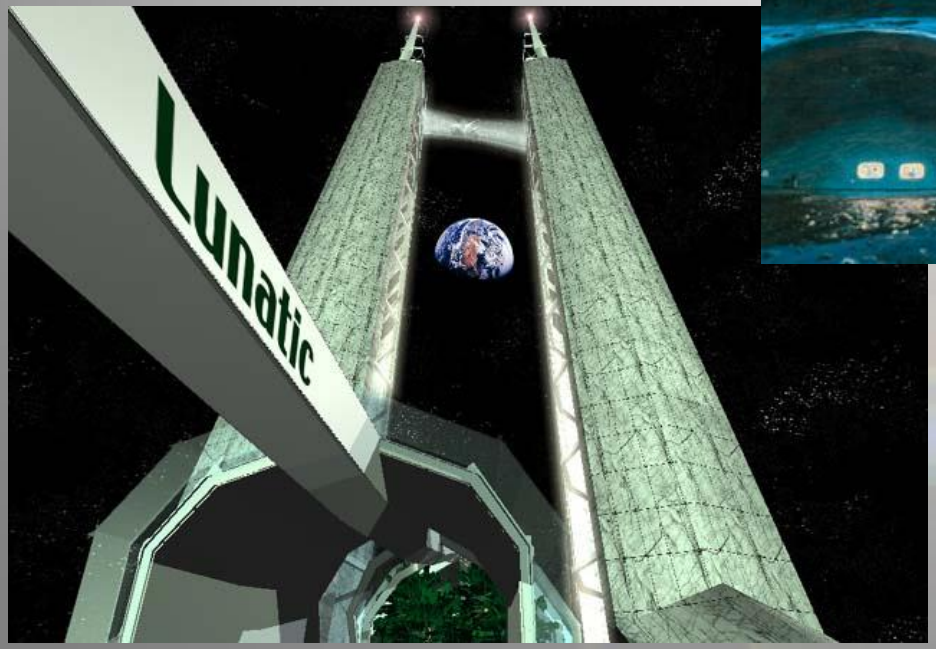
Space in the future

Space Ship Two
Credits: http://en.wikipedia.org/

HyPlane
Credits: Space Renaissence Italia

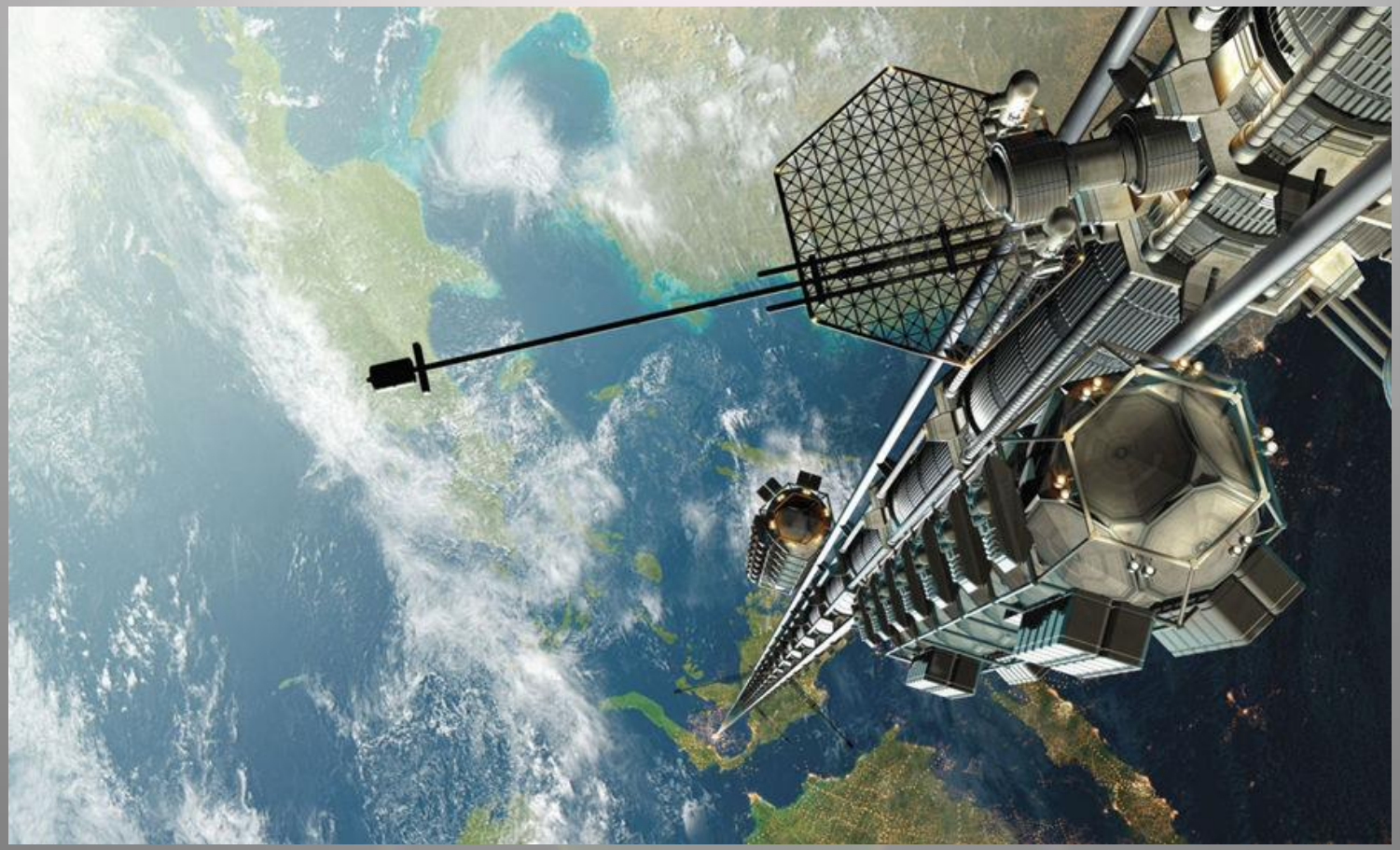
Space in the future

Lunar Hilton Hotel
Credits: http://www.bbc.com/



Entrance of the Moon Hotel
Credits: J. Rombaut - 2001

Space in the future



Space Elevator
Credits: http://nisenet.org/

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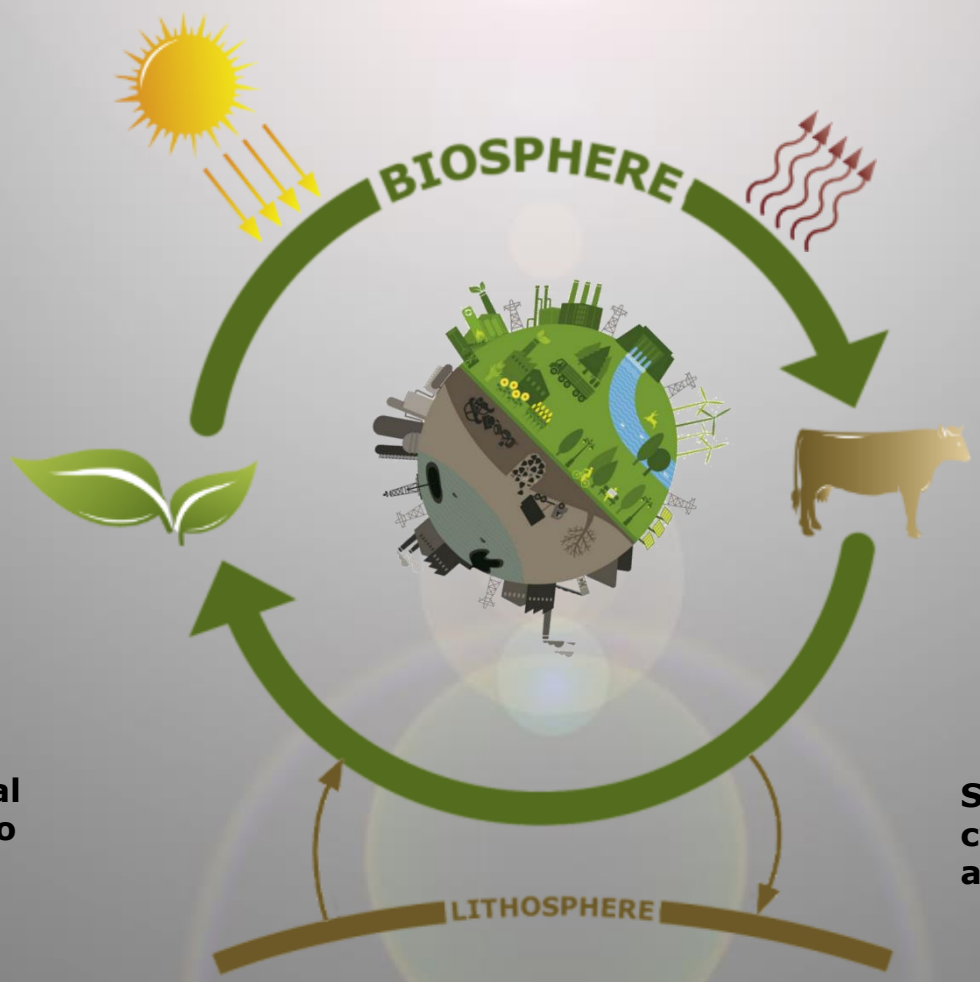
Sustainable society



"Sustainability is the capacity for continuance into the long-term future".

Slow geological cycles (volcano eruptions and weathering)

Slow geological cycles (sedimentation and mineralization)

Credits: Natural Step Italy

4 Sustainability Principles

In a sustainable society, nature is not subject to systematically increasing...

...concentrations of substances extracted from the Earth's crust,

...concentrations of substances produced by society,

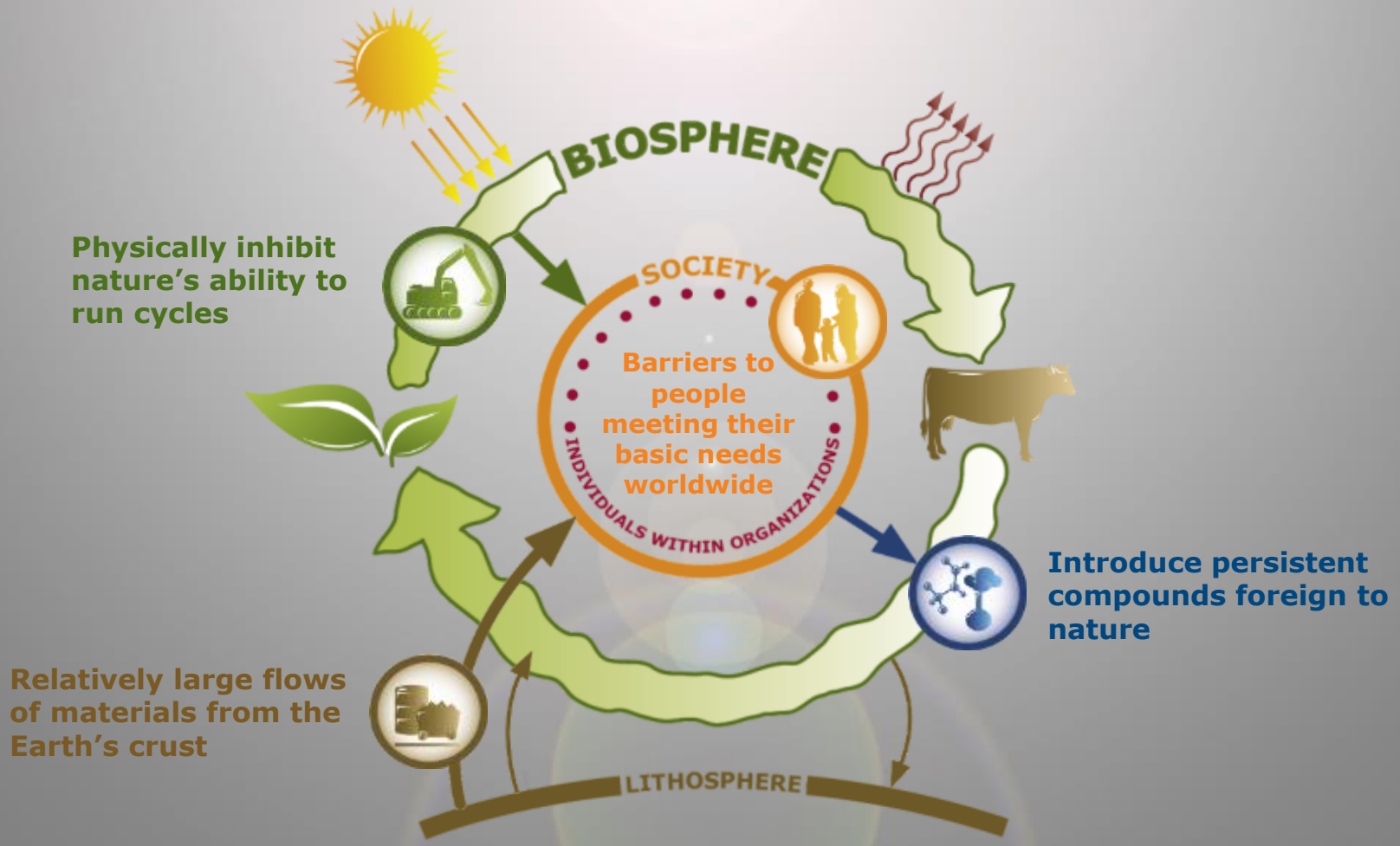
...degradation by physical means,

and, in that society...

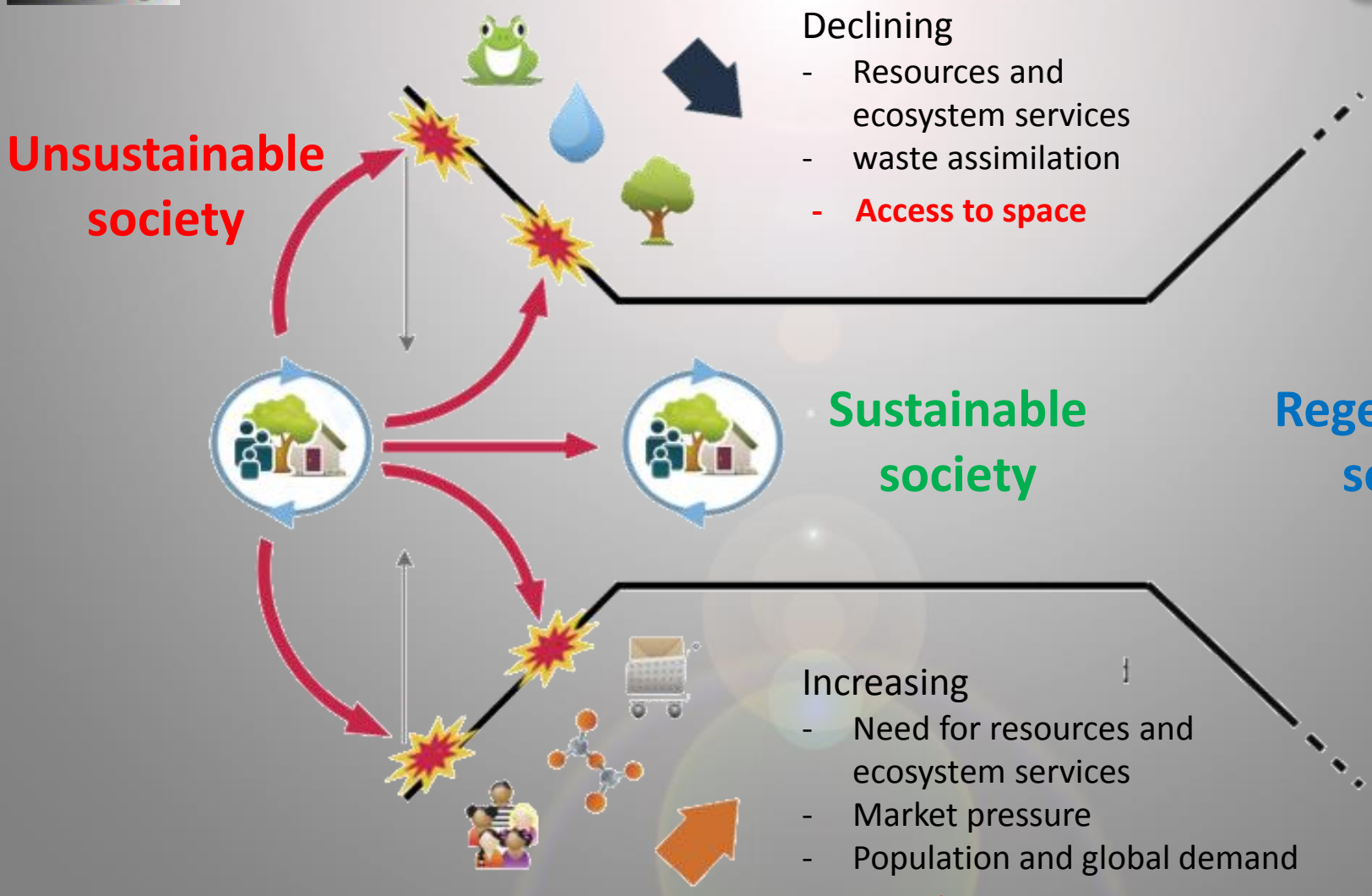
...people are not subject to conditions that systematically undermine their capacity to meet their needs.

Credits: Natural Step Italy

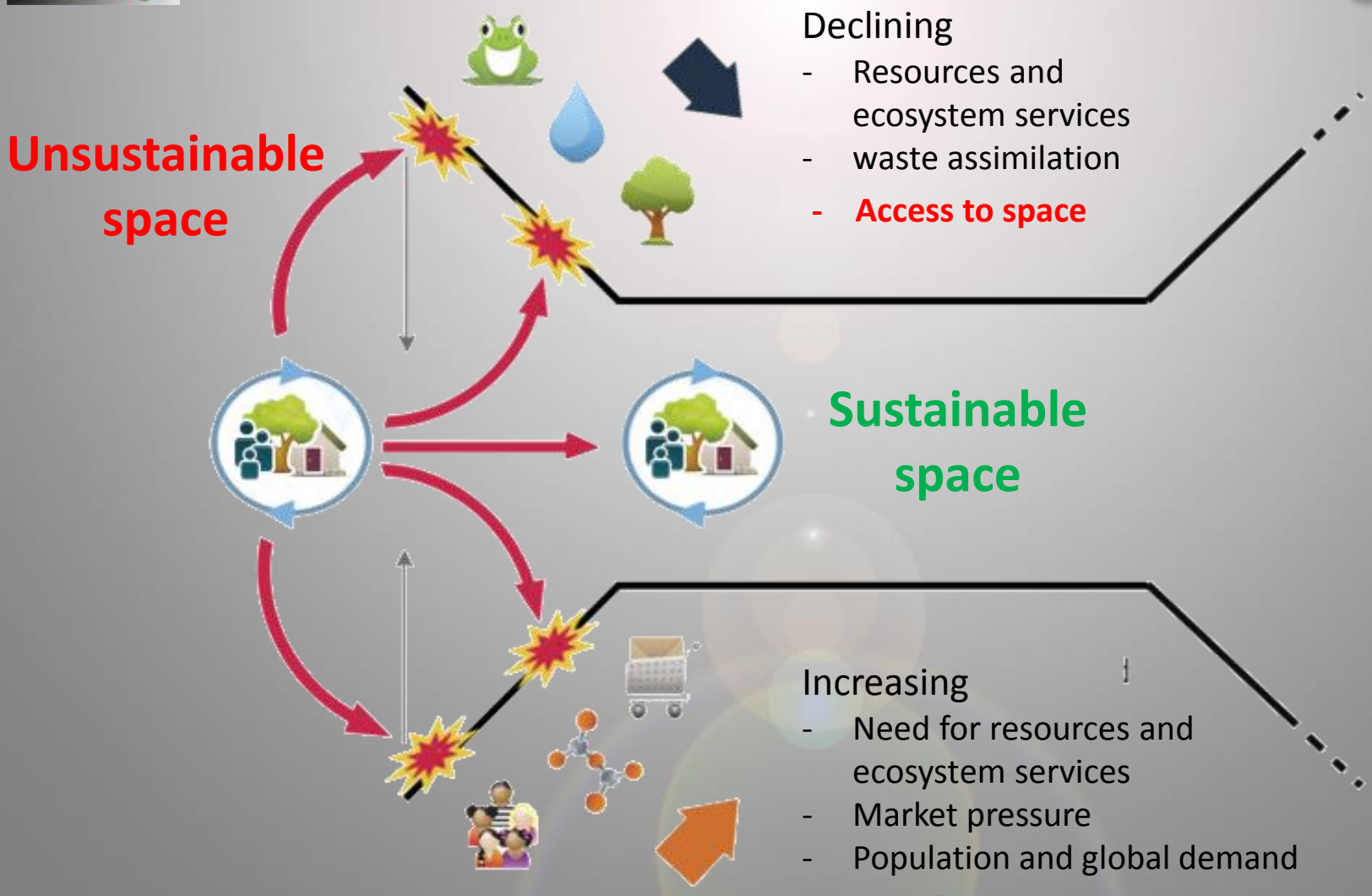
Unsustainable society



Credits: Natural Step Italy

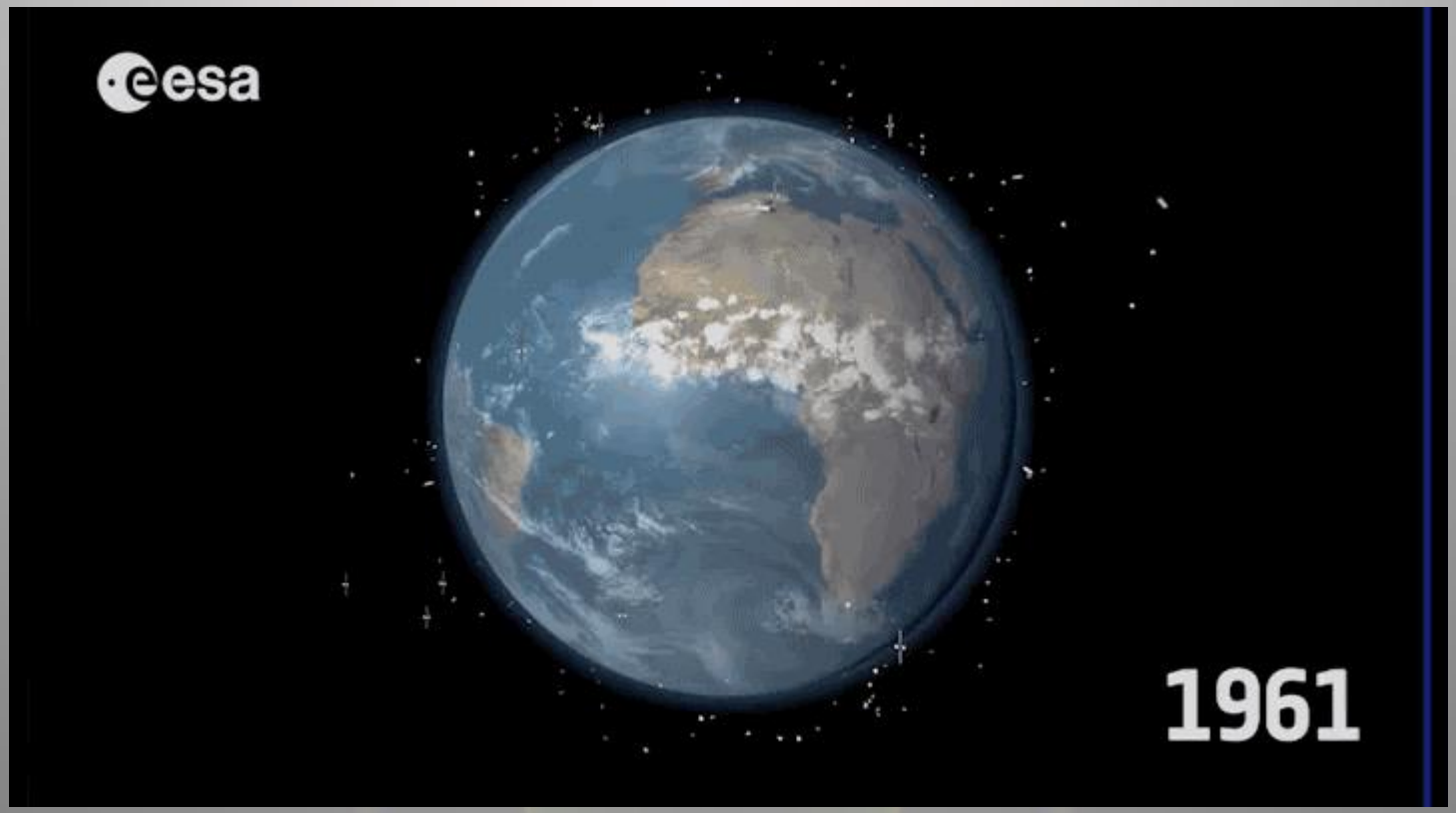


Credits: Natural Step Italy



Credits: Natural Step Italy

Space Debris



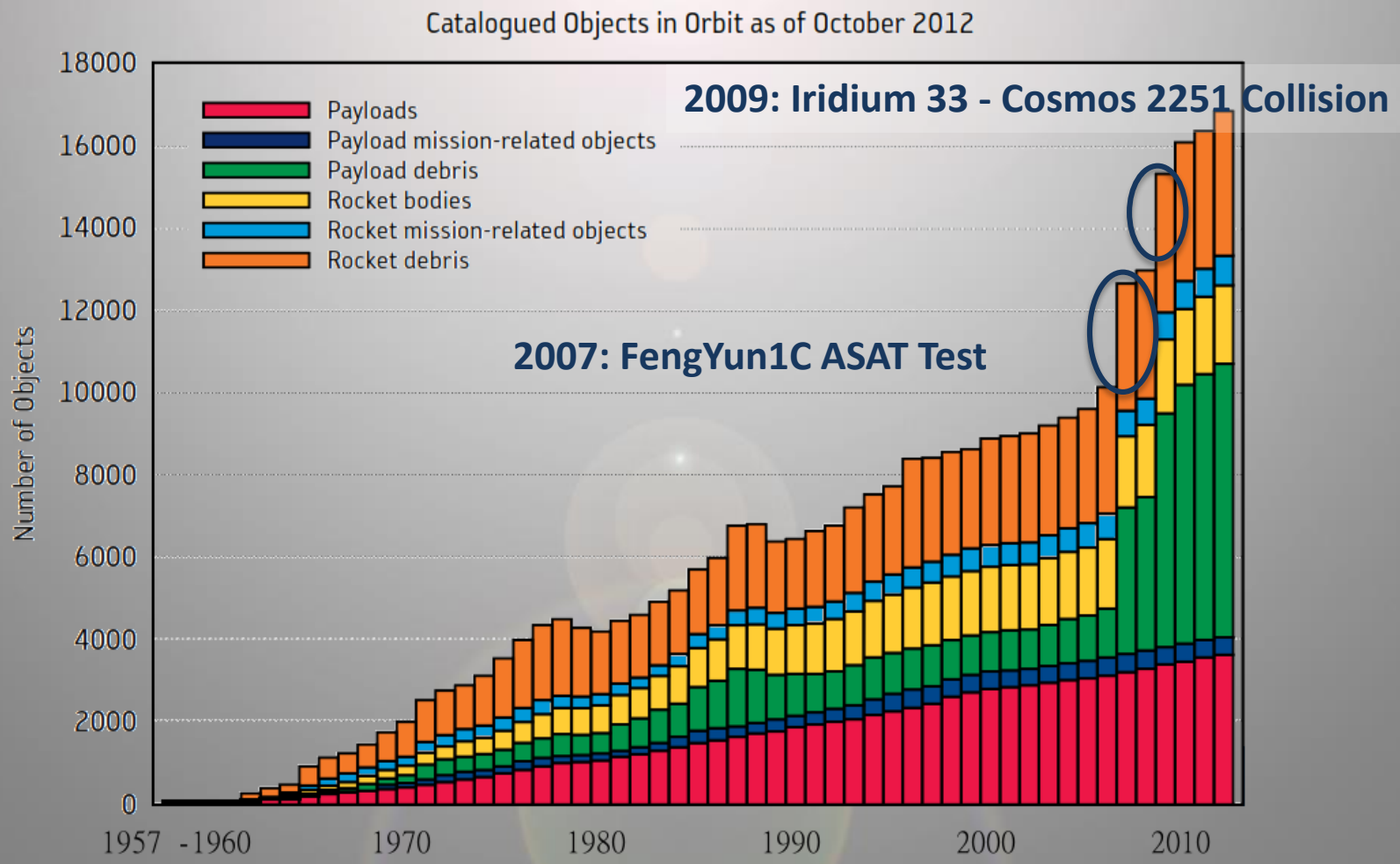
Space Debris

Estimated Orbital Population

Size	Number	% Mass
> 10 cm	> 17,000	99.93
1-10 cm	> 400,000	0.035
< 1 cm	> 35,000,000	0.035
Total	**> 35,000,000**	**> 6,000.0 tonnes**

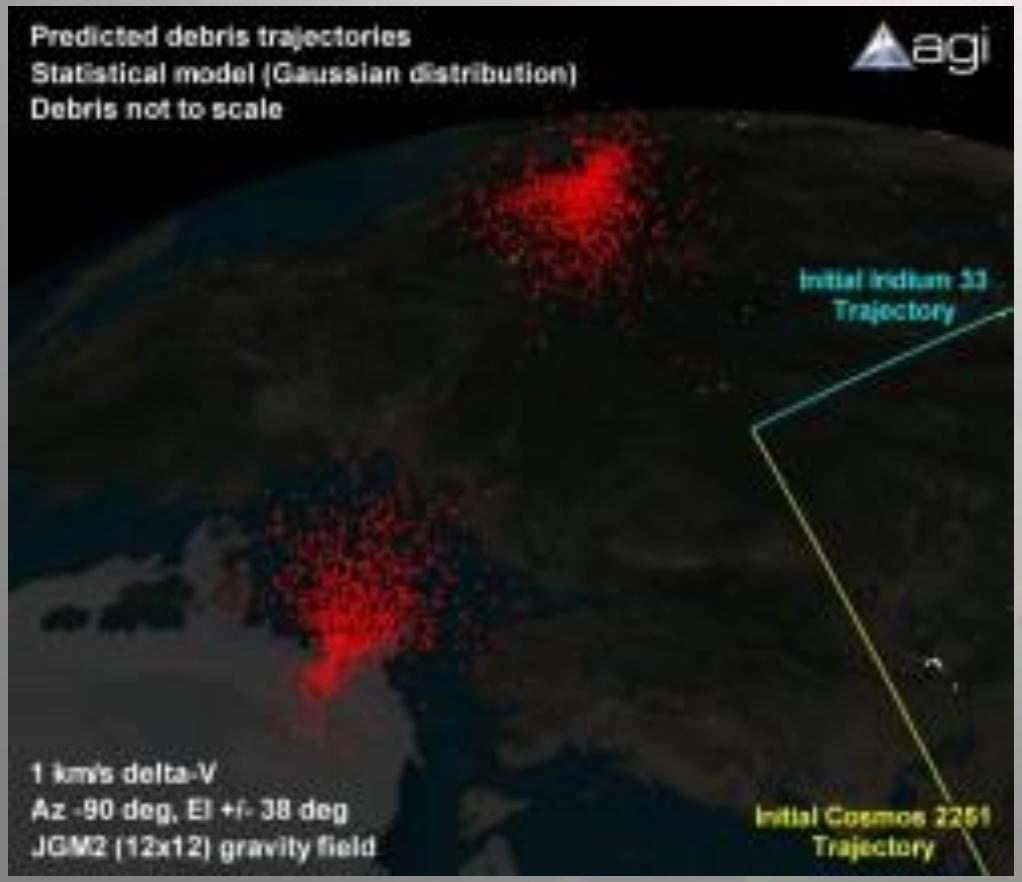
Ref: Reflections on Orbital Debris Mitigation Measures – UK Space Agency

Space Debris



Ref: ESA and space debris – Space Operations

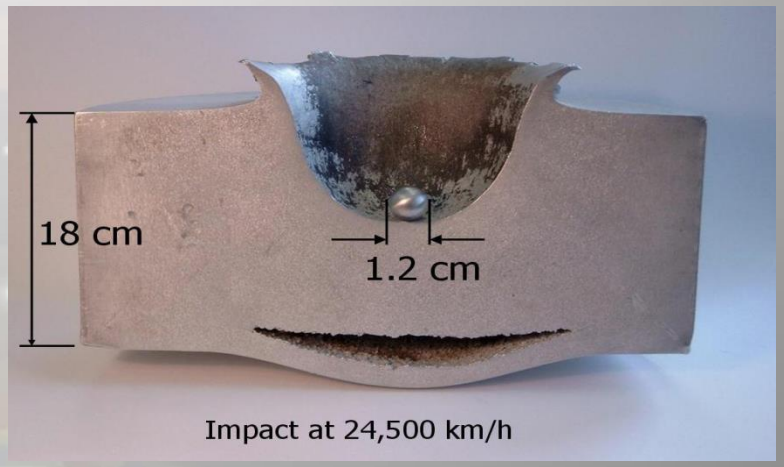
Main critical aspects: In Orbit Satellite collisions



Main critical aspects: In Orbit Satellite collisions

A collision with even a tiny fragment can be devastating at orbital speeds.

In a laboratory experiment conducted at the European Space Agency (ESA), a small aluminium sphere was fired against an 18-centimetre-thick aluminium block. The projectile was travelling at about 6.8 km/s. The image clearly depicts the resulting damage. An active satellite would experience similar effects in the event of a collision with space debris.

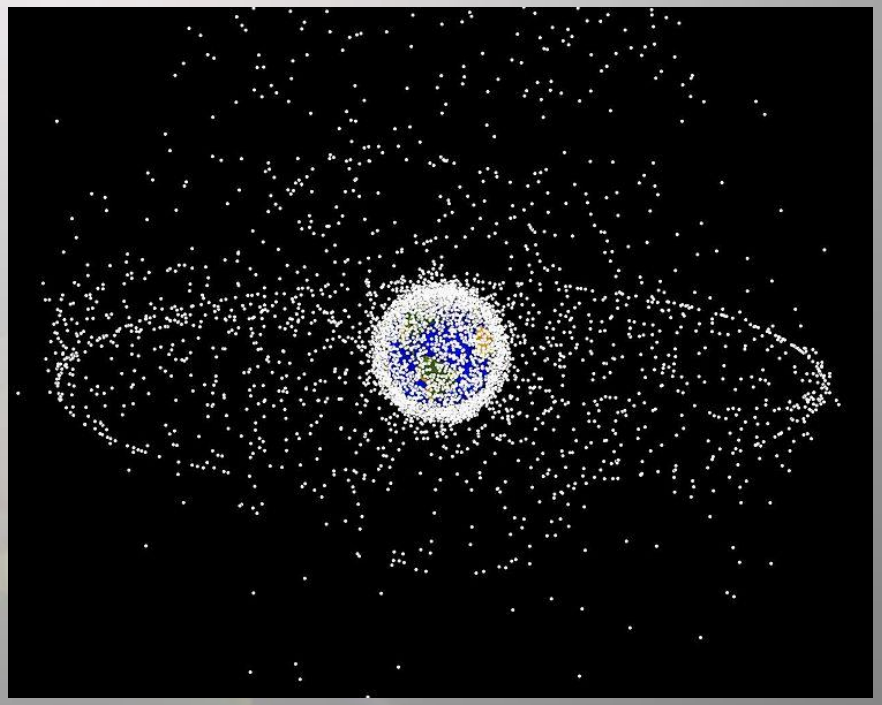


Ref: ESA and space debris – Space Operations

Main critical aspects: Uncontrolled reentry

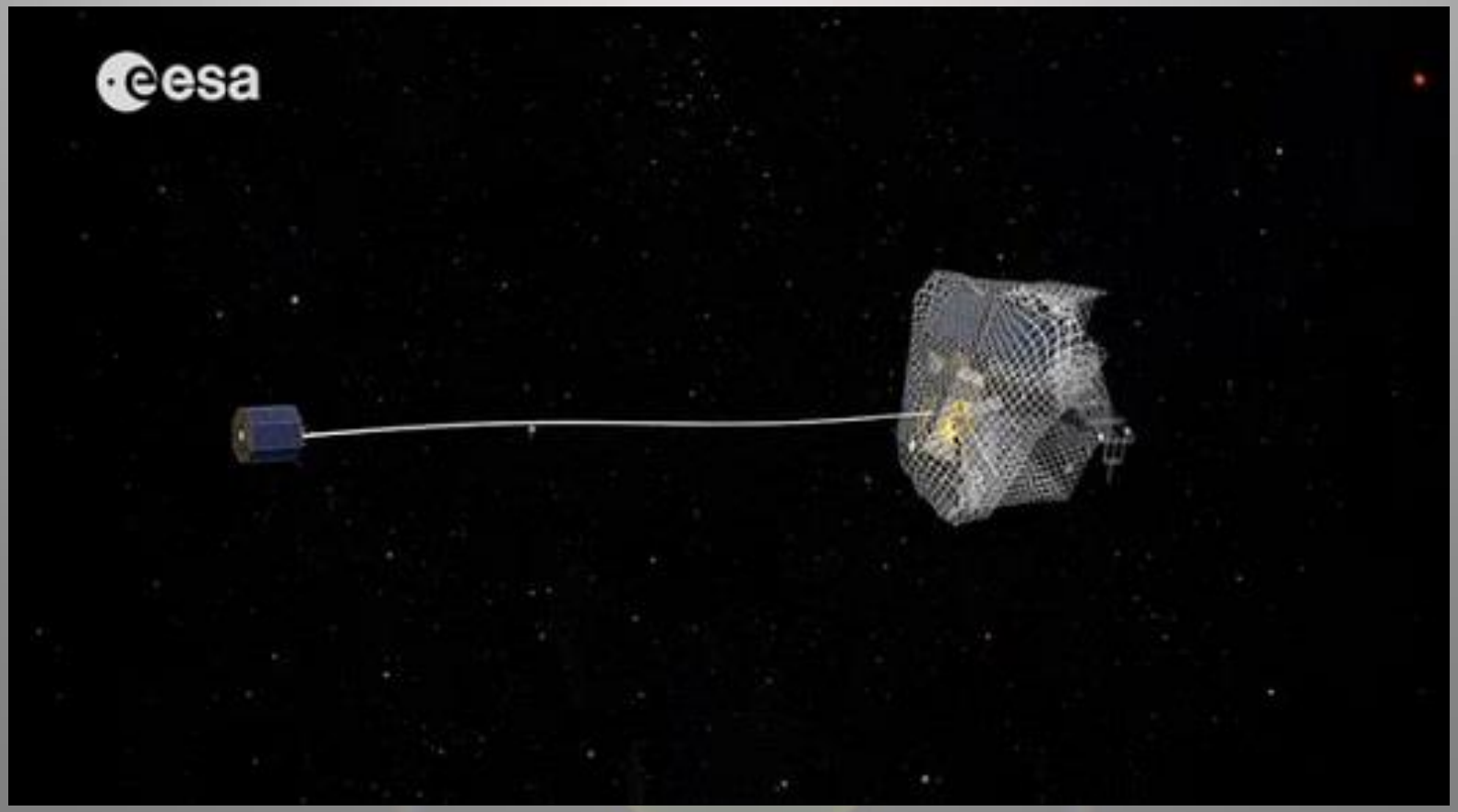
Main critical aspects: Limit future access to Space

The **Kessler** syndrome, proposed by the NASA scientist Donald J. Kessler in 1978, is a scenario in which the density of objects in low Earth orbit (LEO) is high enough that collisions between objects could cause a cascade—each collision generating space debris which increases the likelihood of further collisions.
One implication is that the distribution of debris in orbit could render space exploration, and even the use of satellites, unfeasible for many generations



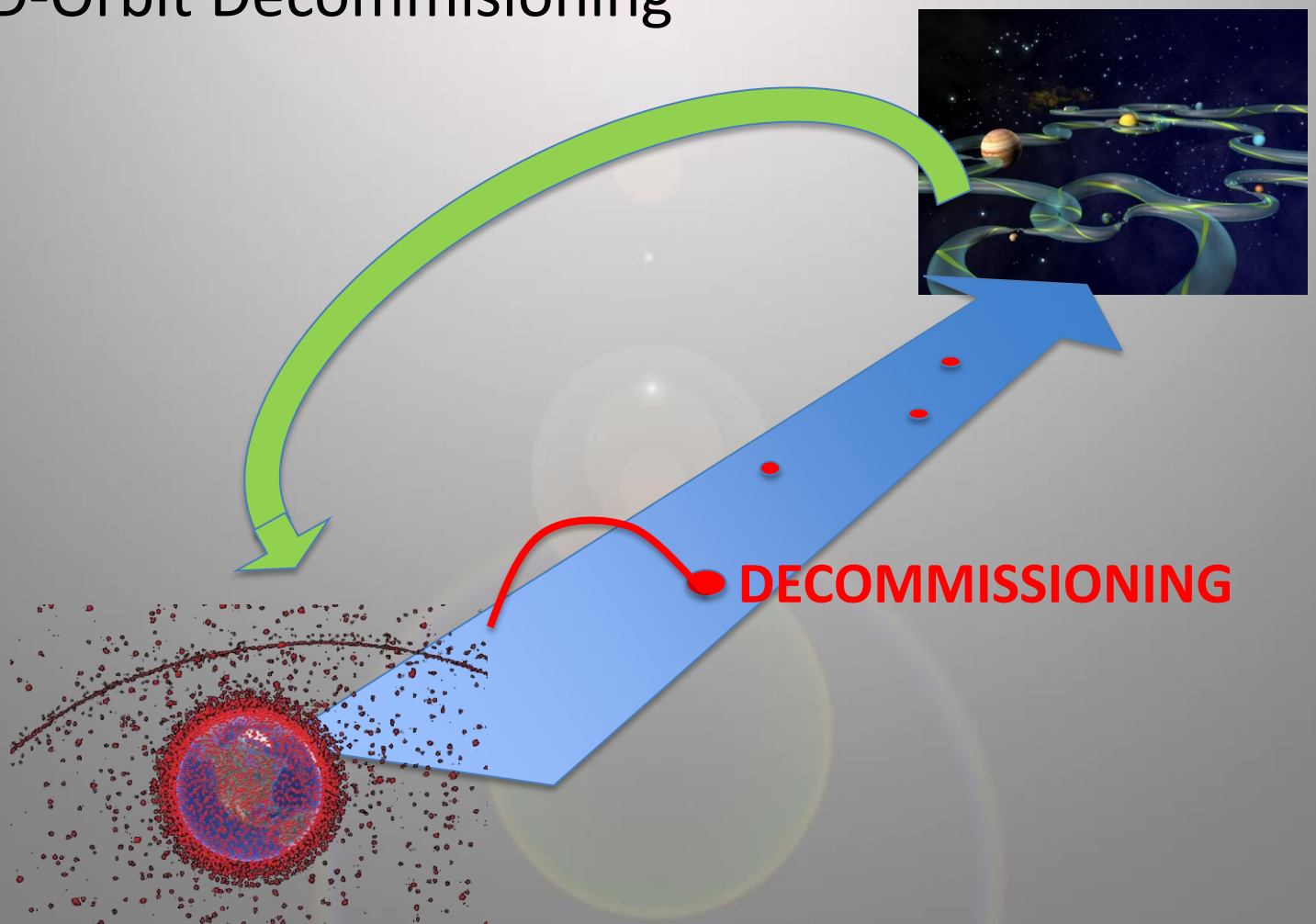
Which are possible solutions?

- Active Debris Removal



Which are possible solutions?

- D-Orbit Decommisioning



We add 5th Sustainability Principle

In a sustainable society, the system is not subject to systematically increasing...

...concentrations of substances extracted from the Earth's crust,

...concentrations of substances produced by society,

...degradation by physical means,

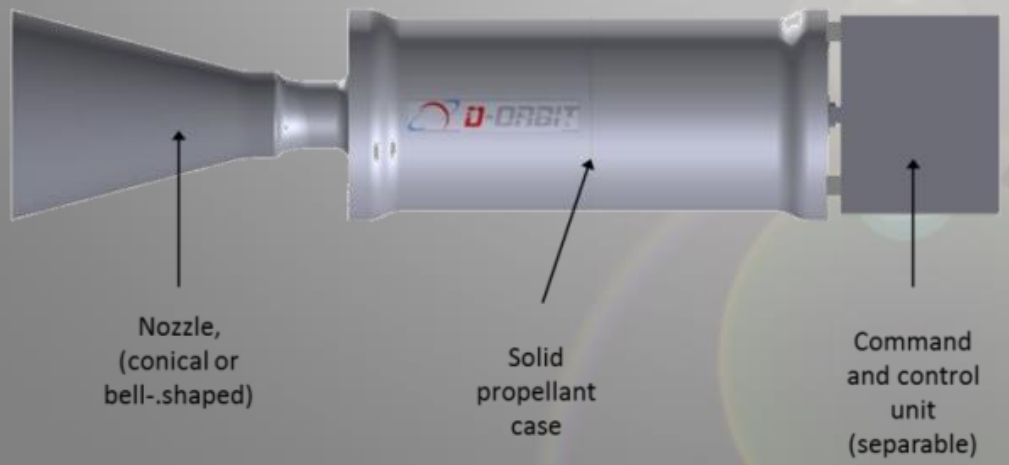
and, in that society...

...people are not subject to conditions that systematically undermine their capacity to meet their needs.

...concentrations of defunct objects around Earth

Which are possible solutions?

- D-Orbit Decommisioning



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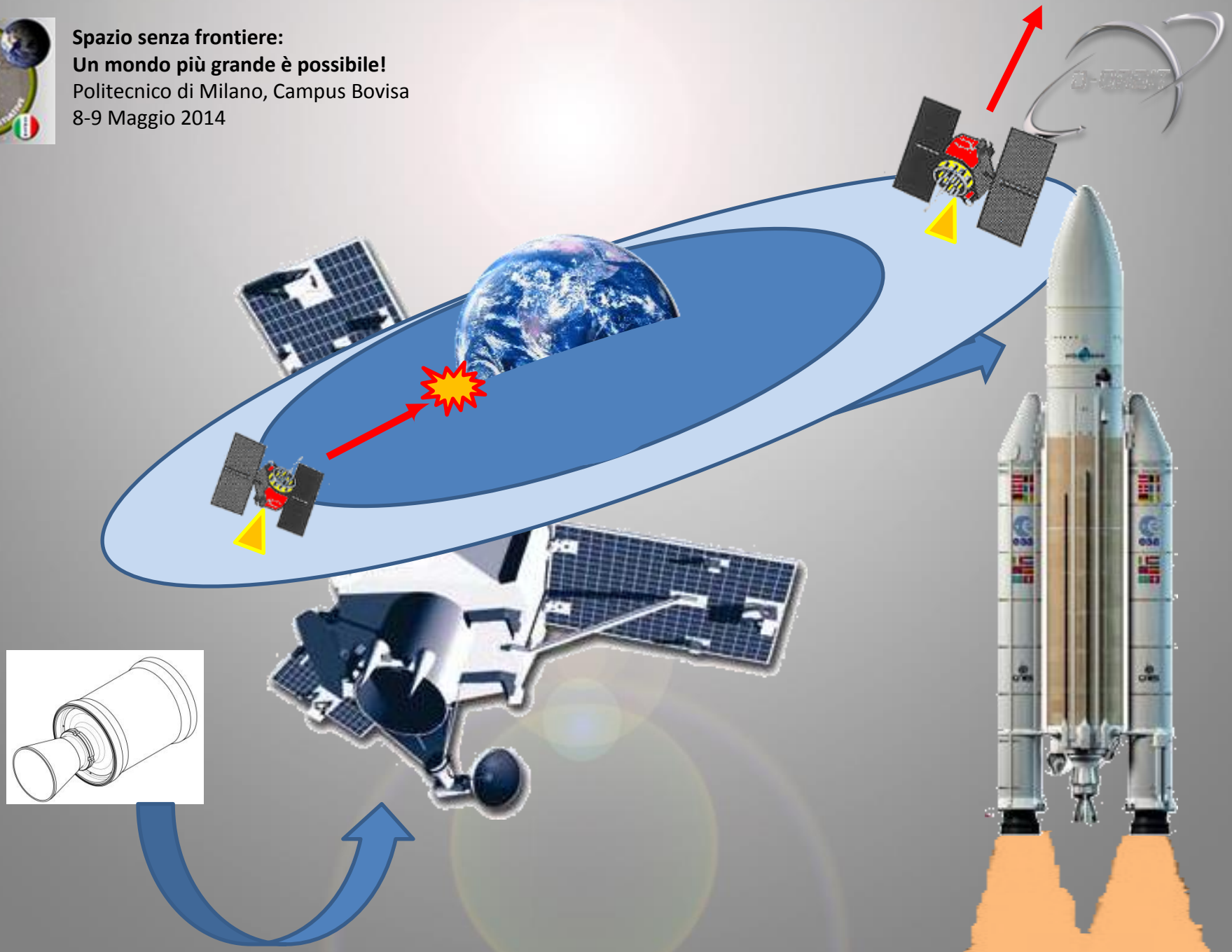

FEATURES

- LEO satellites will be deorbited along a **quick**, **safe** and **controlled trajectory**;
- The final impact area with the Earth's surface will **cover uninhabited areas**;
- Decommissioning could occur in a **few hours**;

- GEO and MEO satellites will be re-orbited into **graveyard orbits** along predefined trajectories through a dedicated decommissioning system;

BENEFITS

- Life extension of space missions;
- Easy EOL operations and reduced costs;
- Reduction and cancellation of monitoring costs of future dead satellite
- Back-up propulsion system for rapid collision avoidance maneuvers or a fast correction of the satellite orbital position (de/re-orbiting still possible);
- Compliance now and in the future with even more stringent Space Debris Regulations.

The first step towards a sustainable exploitation of Space.

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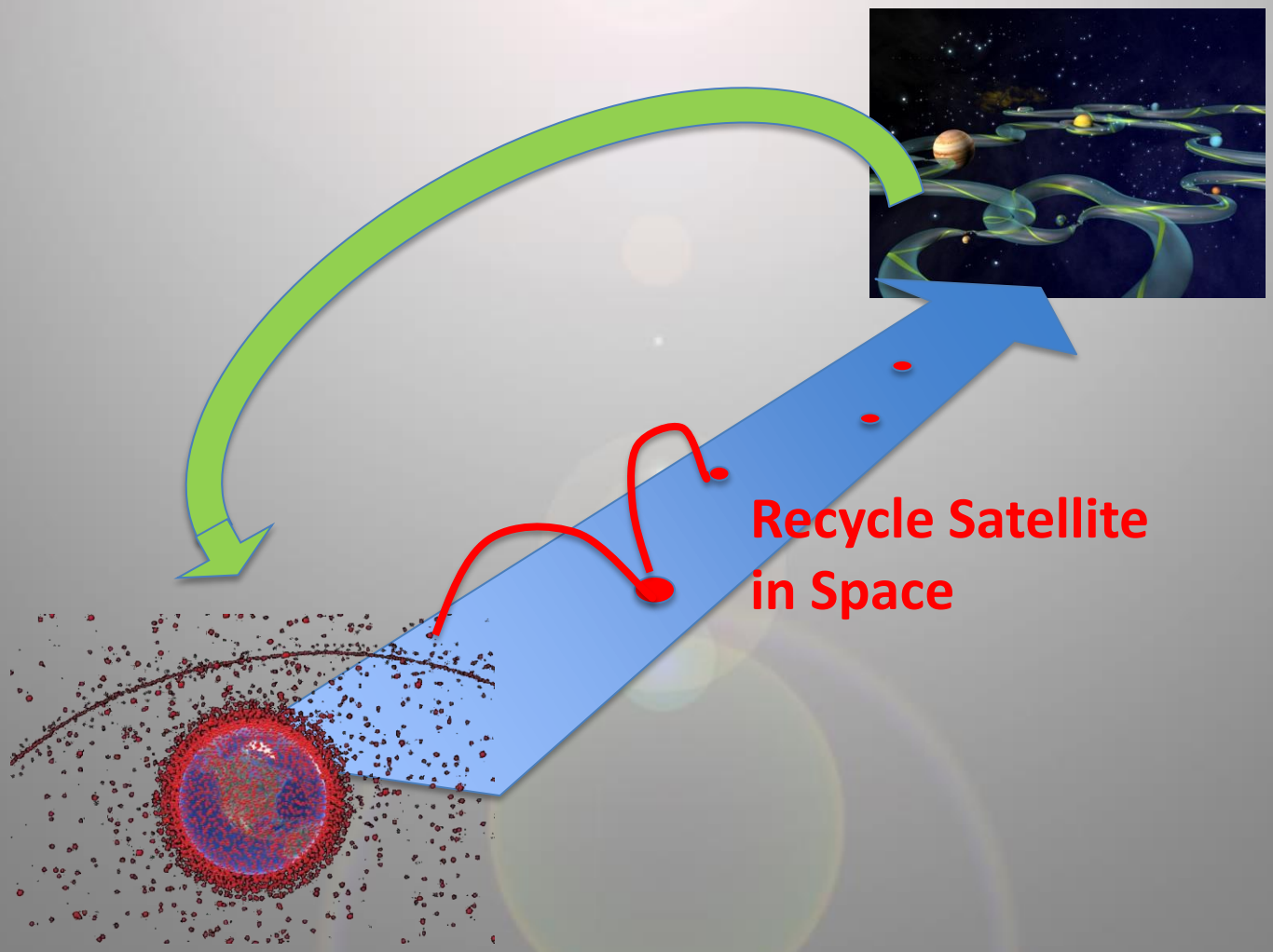

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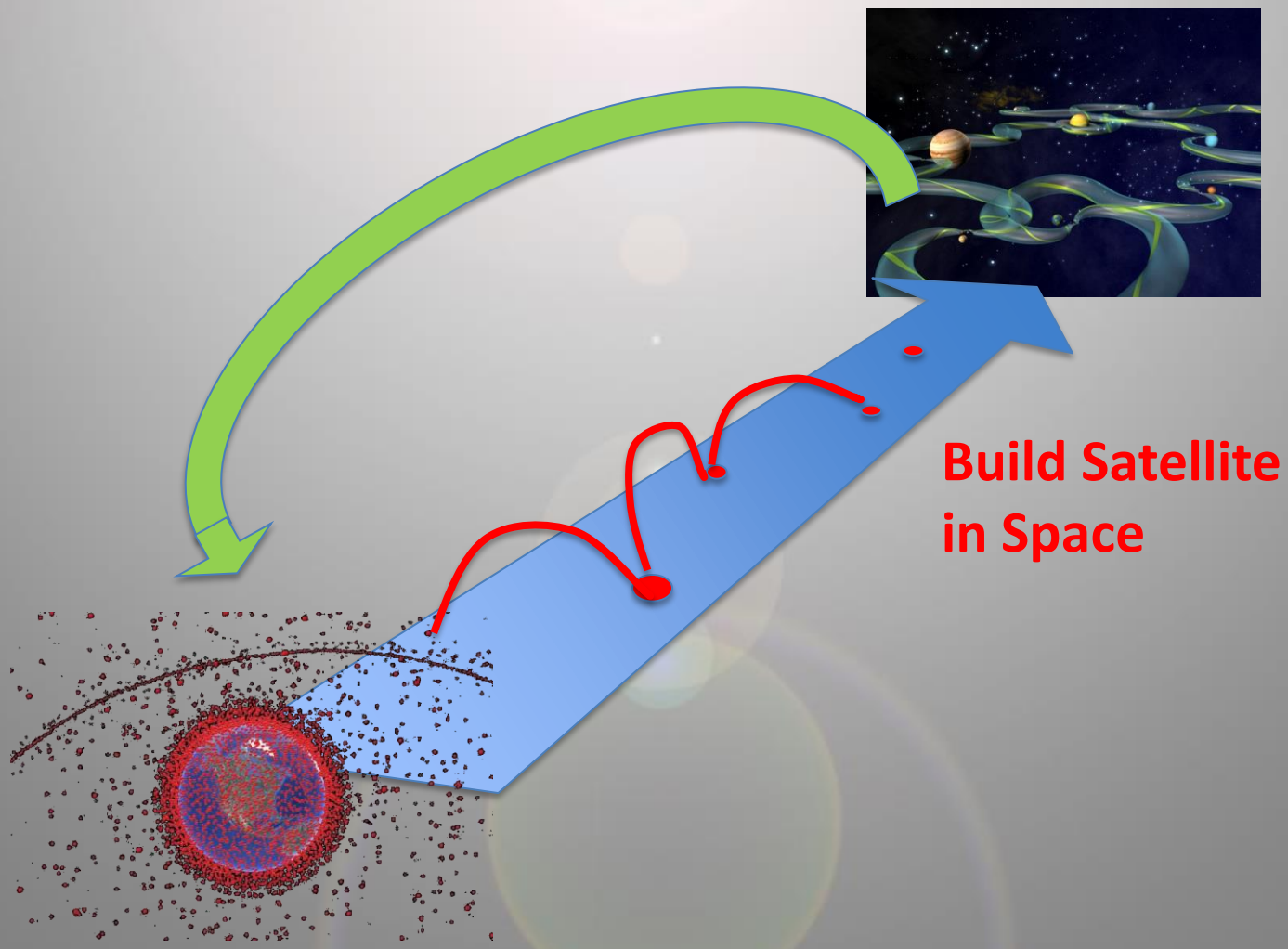

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www.deorbitaldevices.com

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