



## Uncontrolled Re-Entries of Satellites

**Prelims:** Outer Space Institute, Stages of Rocket launch, ISRO, RISAT-2.

**Mains:** Uncontrolled Re-Entries of Satellites and Associated Concerns.

### Why in News?

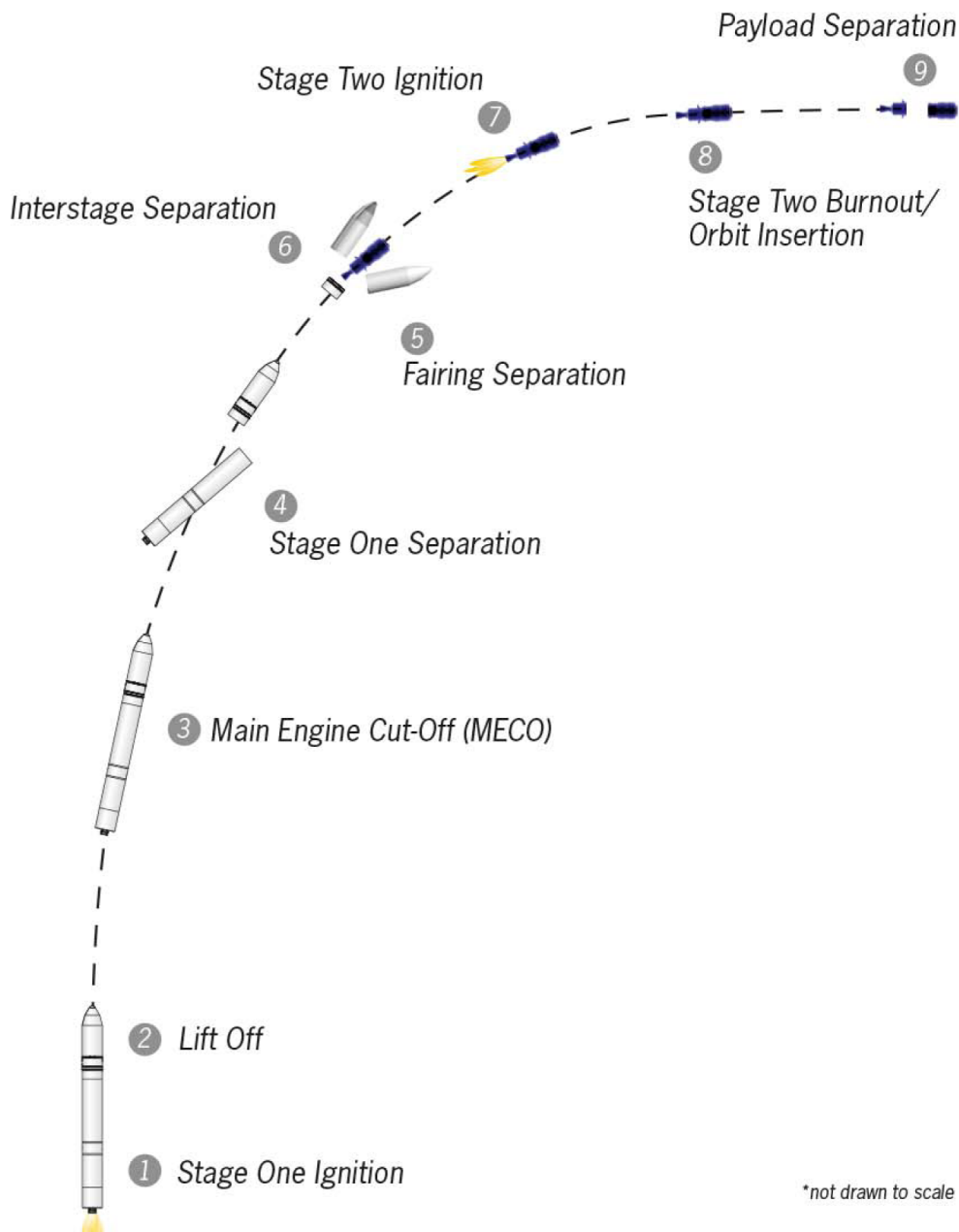
Outer Space Institute (OSI) has called for both national and multilateral efforts to **restrict uncontrolled re-entries** of Satellites.

- **OSI** is a network of **world-leading space experts united by their commitment to highly innovative, transdisciplinary research** that addresses grand challenges facing the continued use and exploration of space.

### What are the Stages of a Rocket Launch?

- **Primary Stage:**
  - The primary stage of a rocket is **the first rocket engine to engage, providing the initial thrust to send the rocket skyward.**
  - This engine will continue to operate until its fuel is exhausted, at which time it separates from the rocket and falls to the ground.
- **Secondary Stage:**
  - After the primary stage has fallen away, **the next rocket engine engages to continue the rocket on its trajectory.**
  - The second stage has considerably **less work to do, since the rocket is already traveling at high speed** and the rocket's weight has significantly decreased due to the separation of the first stage.
  - If the rocket has additional stages, **the process will repeat until the rocket is in space.**
- **Payload:**
  - Once the payload, whether it be a satellite or a spacecraft, is in orbit, the **rocket's final stage falls away, and the craft will be maneuvered** using smaller **rockets whose purpose is to guide the spacecraft.** Unlike the main rocket engines, these maneuvering rockets can be used multiple times.

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## What is Uncontrolled Re-entry?

- In an uncontrolled re-entry, the rocket stage simply falls. Its path down is **determined by its shape, angle of descent, air currents and other characteristics.**
- It will also disintegrate as it falls. As the smaller pieces fan out, **the potential radius of impact will increase on the ground.**
- Some pieces burn up entirely while **others don't.** But because of the speed at which **they're travelling, debris can be deadly.**
  - **As per a 2021 report of the International Space Safety Foundation,** an impact anywhere on an airliner with debris of mass above 300 grams would produce **a catastrophic failure, meaning all people on board would be killed.**
- Most rocket parts have landed in oceans principally because earth's surface has more water than land. But many have dropped on land as well.

## What are the Concerns?

- There have been many instances in the past **where rockets striking some parts on Earth.**

- Russian rocket in 2018 and [China's Long March 5B](#) rockets in 2020 and 2022 striking parts of Indonesia, Peru, India and Ivory Coast, among others.
- Parts of a [SpaceX Falcon 9](#) that fell down in Indonesia in 2016 included two “refrigerator-sized fuel tanks”.
- If re-entering **stages still hold fuel, atmospheric and terrestrial chemical** contamination is another risk.
- It is estimated that casualty risk from uncontrolled rocket body re-entries will be of order of 10% in the next decade” and that **countries in the ‘Global South’ face a “disproportionately higher” risk of casualties.**
  - The U.S. Orbital Debris Mitigation Standard Practices (ODMSP) require all launches to keep the chance of a casualty from a re-entering body to be below 0.01%.
- There is **no international binding agreement to ensure rocket stages** always perform controlled re-entries nor on the technologies with which to do so.
- The **Liability Convention 1972** requires countries to pay for damages, **not prevent them.**
- These technologies include wing-like attachments, de-orbiting brakes, and extra fuel on the re-entering body, **and design changes that minimize debris formation.**

## What can make Minimum Damage?

- Future solutions need to be extended not just launching satellites but to re-entering satellites as well.
- Advances in electronics and fabrication have made way for smaller satellites, **which are easier to build and launch in large numbers.** These satellites experience more atmospheric drag than if they had been bigger, **but they are also likely to burn up during re-entry.**
  - India's 300-kg [RISAT-2 satellite](#) re-entered earth's atmosphere in October after 13 years in low-earth orbit. The [ISRO \(Indian Space Research Organisation\)](#) tracked it with its system for safe and sustainable space operations management from a month beforehand. It plotted its predicted paths using models in-house.

## Note

- The Soviet Union launched the **first artificial satellite in 1957.**
- There are **more than 6,000 satellites in orbit**, most of them in **low-earth** (100-2,000 km) and **geostationary** (35,786 km) orbits, placed there in more than 5,000 launches.
- The number of rocket launches have been surging with the advent of reusable rocket stages.

## UPSC Civil Services Examination, Previous Year Questions (PYQs)

### Prelims

**Q. Satellites used for telecommunication relay are kept in a geostationary orbit. A satellite is said to be in such an orbit when: (2011)**

1. The orbit is geosynchronous.
2. The orbit is circular.
3. The orbit lies in the plane of the Earth's equator.
4. The orbit is at an altitude of 22,236 km.

**Select the correct answer using the codes given below:**

- (a) 1, 2 and 3 only
- (b) 1, 3 and 4 only
- (c) 2 and 4 only
- (d) 1, 2, 3 and 4

**Ans: (a)**

**Mains**

**Q.** Discuss India's achievements in the field of Space Science and Technology. How the application of this technology has helped India in its socio-economic development? **(2016)**

**Source: TH**

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