Risk of Interplanetary Contamination on Mars

Why in News

Recently, astrobiologists have **expressed concerns** about possible **'interplanetary contamination'** on Mars as ambitious space missions are proliferating the space along with advances in commercial flight.

- Interplanetary contamination refers to **biological contamination of a planetary body** by a space probe or spacecraft, either deliberate or unintentional.

Key Points

- **Context:** In the past several missions have launched to Mars e.g. **China's Tianwen-1** which aims to land on the Red Planet's surface, and the **UAE's Al Amal (Hope)** which does not involve a landing, but an orbital mission that will study the Martian atmosphere.
    - The USA will soon launch its **Perseverance mission,** which would be the **National Aeronautics and Space Administration's (NASA)** **10th** successful Mars landing since 1975.
        - The Perseverance is a **rover name for NASA's Mars 2020 mission**.
        - It will seek signs of ancient life and collect rock and soil samples from the planet.
    - In the past, **space missions have established physical contact** with astronomical bodies such as **comets and asteroids**, and crewed missions have landed on the Moon.
    - However, since these **bodies are known to be hostile to life,** the possibility of their contamination has not been a pressing issue.
- **Type of Contamination:** There are two types of contamination i.e. forward and backward contamination.
    - **Forward Contamination:** It means the **transport of Earth-based microbes** to other celestial bodies.
        - Since, **presence of liquid water** was already discovered on Mars there is a **chance that Mars has life** and it is an ethical obligation on humanity to ensure that microbes from **Earth do not disturb a possible Martian biosphere,** allowing it to evolve in its own way.
        - Secondly, **Earth-based organisms could spoil the integrity of the Red Planet's samples** that rovers want to study – a highly disruptive concept for scientists who are looking for signs of native Martian life.
    - **Back Contamination:** It is the **transfer of extraterrestrial organisms** (if they exist) into the Earth's biosphere.
        - The **scientists rule out back contamination** with respect to **Mars sample-return mission** as their **biochemistry would be markedly different from that on Earth**.
- **Planetary Protection:**
    - **United Nations Outer Space Treaty of 1967:** It **serves as a defence mechanism**

against the militarisation of space and also requires nations to worry about contamination risks.

        - Its 110 state parties include the **USA, Russia, China, and India**.
        - To ensure compliance with the **Treaty, the Committee on Space Research** (COSPAR) lays down a **'planetary protection policy'** that aims to limit the number of microbes sent to other planets, as well as ensuring that alien life does not cause havoc on Earth.
- **Impact of the Policy:** The guidelines have had far-reaching implications on human spacecraft design, operational procedures, and overall mission structure.
    - Both NASA and the **European Space Agency** (ESA) have also appointed Planetary Protection Officers.
- **Solutions:**
    - **Spacecraft Sterilisation:** To prevent forward contamination, space missions take care to ensure that spacecraft are sterilised.
        - Previous Mars missions, such **as NASA's Viking landers of the 1970s,** were all sterilised before being launched into space.
        - **NASA's Perseverance mission** was also postponed for a second time to resolve a potential contamination issue.
- **Containment:** In the case of back contamination, sterilisation would not be an option–as this would ruin the extraterrestrial samples.
    - **Containment** would be the only option to break the **chain of contact between possible alien microbes** and life on Earth.

Way Forward

- In the present times nations have been fighting a race to get a strategic edge and **compromising the ethical aspects** of space technology. Therefore, it is important to acknowledge that space may not become **purely a military domain** due to weaponisation of the space.
- Space must be used only for peaceful purposes and any violation of Outer Space must not be tolerated.
- The natural biosphere of earth and other planetary bodies must be ensured through international cooperation.

Source: IE