

1. What is the Starlink internet venture? How is different from other internet services? Discuss.

Approach-

Candidates need to write about the starlink internet services how it works and how it's different from the other internet service.

Introduction

Starlink is a SpaceX project to build a broadband network with a cluster of orbiting spacecraft that could eventually number thousands. Starlink currently has 1,385 satellites in orbit and has already started beta testing in North America and initiating pre-orders in countries like India.

Body

Difference from other internet services:

- **Space Infrastructure:** Satellite Internet is the technology that beams the internet down from a satellite that's orbiting the earth. It will use geostationary (GEO) and medium earth orbit (MEO) satellites, while Starlink and OneWeb use low earth orbit (LEO) satellites.
- **As LEO satellites orbit closer to the earth,** they are able to provide stronger signals and faster speeds than traditional fixed-satellite systems.
- **Latency:** The service offers low-latency broadband internet to remote areas across the globe, using a constellation of satellites in low-Earth orbit. Will help to bring the lag down to 20-30 milliseconds, roughly the time it takes for terrestrial systems to transfer data.
- **Speed difference:** The premium service of starlink claims to provide internet speeds ranging between 150 and 500 mbps. The latency of the premium service is between 20-40ms.
- **Duration and accessible difference:** According to Starlink's website, the premium offering will come with 24x7 support and assist features through a mobile app. In other words, it allows users to connect to the internet beamed from space onto a dish antenna, much like satellite TV.
- **Coverage area difference:** The reason telecom firms want to explore satellite internet is that there are areas where fibre connections just can't reach. Hence, satellite networks are being used to bring connectivity to such areas, which include hills and remote islands.
- **Easier Connectivity:** As satellites appear to be stationary, it is easier to link to them.

Conclusion

While in the short term satellite broadband may only be targeted at remote areas where terrestrial networks haven't reached, in the longer term it could end up competing with these networks even in the developed regions given one key benefit, which is that signals travel faster through space than they do through optic fibre cables.



2. What is the Kavach train protection system? How does it work? Explain.

Approach

Students are expected to write about the Kavach the train protection scheme recently announced in budget explain how it work and it's benefits.

Introduction

The Kavach system was announced in the 2022 Union Budget as a part of the Atmanirbhar Bharat initiative. Around 2,000 km of rail network is planned to be brought under the indigenous system to enable safety and capacity augmentation in 2022-23.

Body

Causes of rail accidents in India:

- Derailments
- Failure of railway staff
- Unmanned level crossings (UMLCs)
- Congestion
- Collisions- Due to foggy weather, low signal visibility, poor signaling etc.

Recently, the Indian Railways tested 'Kavach'-Automatic Train Protection System by making two trains move towards each other at full speed.

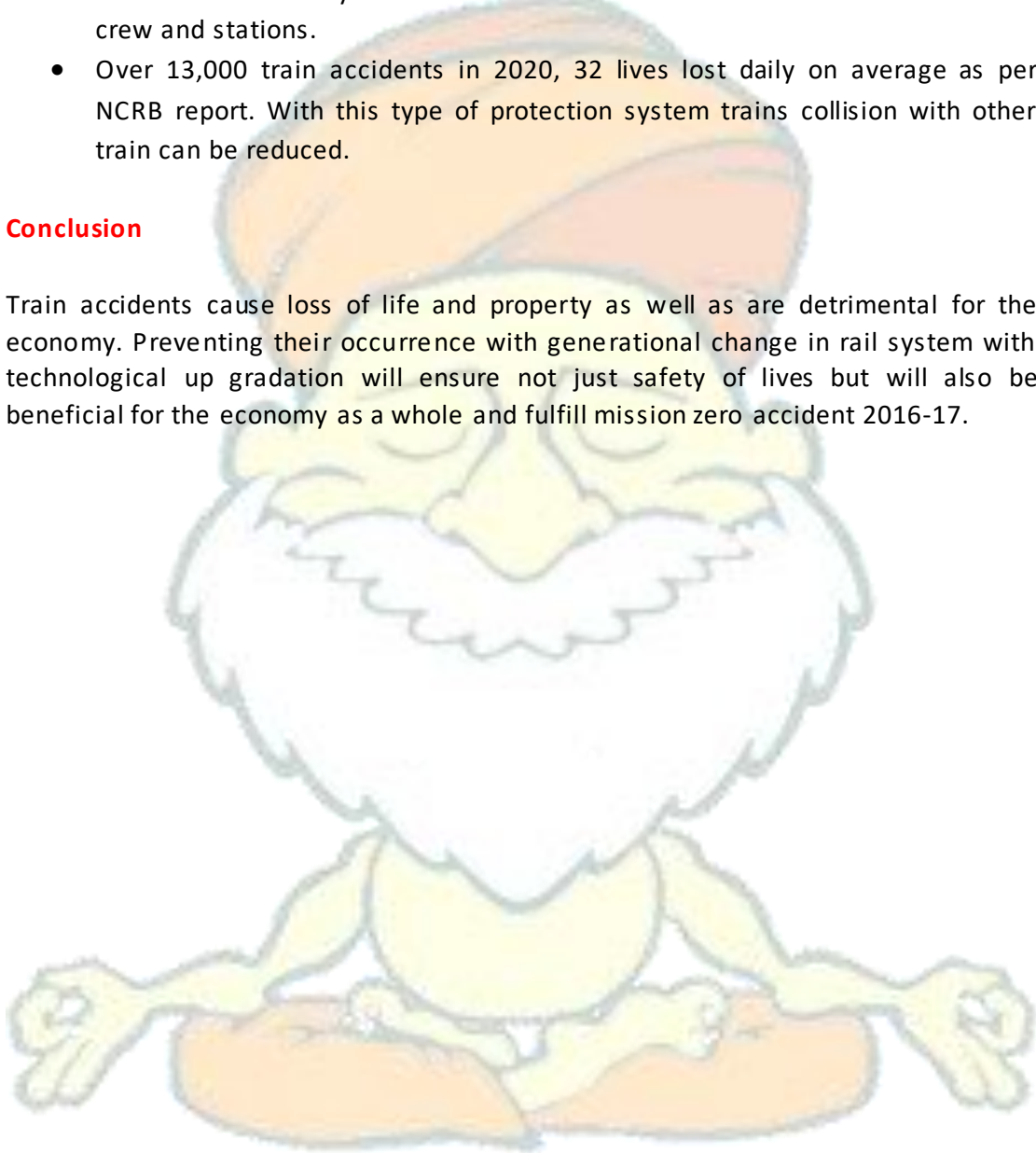
Kavach train protection scheme:

- It is India's very own automatic protection system in development since 2012, under the name Train Collision Avoidance System (TCAS), which got rechristened to Kavach or "armour".
- Simply put, it is a set of electronic devices and Radio Frequency Identification devices installed in locomotives, in the signalling system as well the tracks that talk to each other using ultra high radio frequencies to control the brakes of trains and also alert drivers, all based on the logic programmed into them.
- It continuously refresh the movement information of a train, it is able to send out triggers when a loco pilot jumps signal, called Signal Passed at Danger (SPAD), a grave offence in railway operations with respect to safety, and the key to accidents like collision.
- The devices also continuously relay the signals ahead to the locomotive, making it useful for loco pilots in low visibility, especially during dense fog.

- TCAS or Kavach includes the key elements from already existing, and tried and tested systems like the European Train Protection and Warning System, and the indigenous Anti Collision Device.
- The current form of Kavach adheres to the highest level of safety and reliability standard called Safety Integrity Level 4.
- It will also include stationary equipment to gather signalling inputs and relay them to a central system to enable seamless communication with the train crew and stations.
- Over 13,000 train accidents in 2020, 32 lives lost daily on average as per NCRB report. With this type of protection system trains collision with other train can be reduced.

Conclusion

Train accidents cause loss of life and property as well as are detrimental for the economy. Preventing their occurrence with generational change in rail system with technological up gradation will ensure not just safety of lives but will also be beneficial for the economy as a whole and fulfill mission zero accident 2016-17.



3. What are thermobaric weapons? How do they function? Explain.

Approach-

Candidates need to write about the thermobaric weapons and explain how they function.

Introduction

Fears have risen over the use of thermobaric weapons by Russia after the Ukrainian ambassador to the US said a vacuum bomb – another term for the weapon – had been used during the invasion. These weapons have been used by Russian and western forces since the 1960s. The US relied on them in its attempts to eliminate al-Qaida in the mountains in Afghanistan.

Thermobaric Weapons

- The thermobaric weapon, also known as an aerosol bomb or fuel air explosive, is a two-stage munition.
- These weapons suck in oxygen from the surrounding air to generate a high-temperature explosion and are effective at their “specific purpose” of “primarily destroying defensive positions”.
- While they would not be used to penetrate a tank, they could be a very destructive weapon against an apartment complex or other building.
- They are not illegal even though their effects can be pretty horrific, because of that effect of creating a vacuum and sucking the air out of the lungs of defenders.

How the Thermobaric Weapons Function

- The first-stage charge distributes an aerosol made up of very fine material – from a carbon-based fuel to tiny metal particles.
- A second charge ignites that cloud, creating a fireball, a huge shock wave, and a vacuum as it sucks up all surrounding oxygen.
- The blast wave can last for significantly longer than a conventional explosive and is capable of vaporising human bodies.
- Such weapons are used for a variety of purposes and come in a range of sizes. They are often used in a “bunker-buster” role to destroy defensive positions. Extremely large, air-launched versions are designed to destroy caves and tunnel complexes.

Conclusion

One of the things we know about Russian tactics is that they are willing to destroy everything. It's clear that the Ukrainians are hunkering down in some of the cities as that continues the Russians are going to resort more and more to using whatever weapons they have including thermobaric weapons in built-up urban areas.

