# **Daily News Juice**

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# **1. ISRO to attempt 'docking' satellites in space: What it means, why it matters for future missions**

### **ISRO SpaDeX Docking Mission**

Over the next few days, the Indian Space Research Organisation (ISRO) will bring two small satellites closer together and then join them in space, demonstrating "docking" for the first time. A successful docking will make India the fourth country in the world — after the United States, Russia, and China — to have the capability.

Few days back, ISRO carried out a trial attempt by bringing both the Chaser and Target satellites three metres closer to each other. Afterwards, the satellites were moved apart to safer distances. The space agency is analysing the data for successfully carrying out docking soon.

The two small 220 kg satellites were launched on December 30 from the country's only spaceport in Sriharikota. While being injected into a circular 450 km orbit, a relative velocity was given to the satellites, allowing them to drift away from each other in preparation for the docking experiment.



First, what is docking and why is it necessary?

Docking is a process by which two fast-moving spacecraft are brought to the same orbit, and then closer to each other manually or autonomously, and finally joined together. This capability is necessary for carrying out missions that require heavy spacecraft that a single launch vehicle may not be capable of lifting off with.

The capability is needed not only for setting up a space station — for which separate modules are joined in space — but also for carrying crew and supplies to it.

#### When did the first space docking happen?

With the space race underway, it was essential for the United States to demonstrate rendezvous (bringing spacecraft close to each other) and docking to achieve the objective of sending humans to the moon. In 1966, the Gemini VIII spacecraft became the first to dock with the Agena target vehicle. It was a crewed mission orbiting the Earth. Interestingly, one of the astronauts on board was Neil Armstrong, who went on to become the first person to set foot on the moon in 1969.

While the US mission had astronauts on board to steer the spacecraft, the then Soviet Union in 1967 demonstrated the first uncrewed, automated docking of Kosmos 186 and Kosmos 188 spacecraft.

China first demonstrated its docking capability in 2011, when the unmanned Shenzhou 8 spacecraft docked with the Tiangong 1 space laboratory. A year later, it demonstrated the first crewed space docking, when the astronauts manually joined the Shenzhou 9 spacecraft to the same space laboratory.

#### Why is India conducting a docking mission now?

With its vision of setting up a space station by 2035 and sending humans to the moon by 2040, ISRO has been working on key technologies to realise the vision, such as a new heavy-lift launch vehicle capable of carrying up to 30 tonnes to low earth orbit (an altitude of 2,000 km or less). The missions, however, would require docking capability. Take, for example, the Bharatiya Antariksh Station, which will be built by bringing together five modules in space. The first robotic module is slated to be launched in 2028.

Docking capability will also be required for the next lunar mission Chandrayaan-4, which aims to bring back samples from the moon. The planned mission will see the five key modules sent to orbit in two separate launches. The first launch will have four of the five modules, while the propulsion module will carry the rest of the spacecraft from the Earth orbit to the moon orbit.

From there, the lander and ascender modules will go to the lunar surface and collect the samples, the ascender module will then hop off with the samples and dock with the transfer module in the lunar orbit. This transfer module will carry back the samples to the earth orbit, where it will dock with a re-entry module that will be launched separately. The module will be designed to withstand the heat of entering the Earth's atmosphere. In preparation, the space agency already carried out a hop experiment towards the end of the Chandrayaan-3 mission. A human mission to the moon is likely to follow a similar plan.

#### What will happen during the docking experiment?

To demonstrate docking, several manoeuvres will be carried out to progressively bring the SDX01 or Chaser satellite close to the SDX02 or Target satellite. The satellites will drift closer and halt at 5 km, 1.5 km, 500 m, 225 m, 15 m, and 3 m. Finally, the extended rings on both satellites will come in contact and join. The rings will then be retracted and locked in place.

Once connected, the satellites will share electrical power. The ISRO scientists will also demonstrate giving commands to both the satellites as one. Once successful, the spacecraft will undock and then drift away to remain in space and conduct experiments for the next two years.

#### What does India's docking mechanism look like?

Several types of docking mechanisms have been used by the different space agencies over the years, with some allowing interoperability. The International Docking System Standard is used by spacecraft going to the International Space Station. The docking mechanism being used by India is androgynous — meaning the systems on both the Chaser and Target satellites are identical. It is similar to the International Docking System Standard used by other agencies but uses two motors as compared to the 24 used in IDSS.

The mission will also use several new sensors such as Laser Range Finder, Rendezvous Sensor, Proximity and Docking sensor to take precise measurements while bringing the two satellites closer and joining them. It will also use a new processor based on satellite navigation systems to determine the relative position and velocity of the other spacecraft. This is a precursor to completely autonomous systems for future missions that would be able to achieve docking without satellite-based navigation data.

Relevance: GS Prelims & Mains Paper III; Science & Technology Source: Indian Express

# 2. Kumbh Mela, explained: Its mythology, history, astrology, and why millions flock to it

#### Maha Kumbh Mela Mythology, History, Astrology

It is cold in Prayagraj, foggy with a chance of rain. Yet, tens of thousands are expected to arrive in the city, to camp on the banks of the Ganga. They will stay in tents and bathe in the river, the most devout taking a dip at dawn while stars are still twinkling.

Prayagraj is hosting the Maha Kumbh this time, or the Poorna Kumbh, held every 12 years. Many myths are prevalent around the Kumbh Mela, many theories about its exact origin. Some believe the festival finds mention in the Vedas and Puranas. Some say it is far more recent, going back barely two centuries. What is known for certain is that today, it is one of the largest gatherings of devotees witnessed anywhere on earth.

What is the Kumbh Mela, and why is it held in four cities periodically? What is Ardh Kumbh and Maha Kumbh? What is the origin of this festival, and why do millions attend it?

The answers, as in many questions about Hinduism, lie in a mixture of myths, history, and the enduring faith of an ancient people, trusting as much in the munificence of invisible deities as in tangible life-givers like rivers.

#### The mythological origins of the Kumbh Mela

The Sanskrit word kumbh means pitcher, or pot. The story goes that when Devas (gods) and Asuras (loosely translated as demons) churned the ocean, Dhanvantri emerged carrying a pitcher of amrita, or the elixir of immortality. To make sure the Asuras don't get it, Indra's son, Jayant, ran off with the pot. The Sun, his son Shani, Brihaspati (the planet Jupiter), and the Moon went along to protect him and the pot.

As Jayant ran, the amrita spilt at four spots: Haridwar, Prayagraj, Ujjain, and Nashik-Trimbakeshwar. He ran for 12 days, and as one day of the Devas is equal to one year of humans, Kumbh Mela is celebrated at these locations every 12 years, based on the relative positions of the Sun, the Moon, and Jupiter.



Prayagraj and Haridwar also hold the Ardh-Kumbh (ardh means half), every six years. The festival held after 12 years is called the Poorna Kumbh, or the Maha Kumbh.

All four places are located on the banks of rivers — Haridwar has the Ganga, Prayagraj is the sangam or meeting point of Ganga, Yamuna and the mythical Saraswati, Ujjain has the Kshipra, and Nashik-Trimbakeshwar the Godavari.

It is believed that taking a dip in these rivers during Kumbh, amid the specific alignment of the heavenly bodies, washes away one's sins and accrues punya (spiritual merit).

Kumbh Melas are also the venue where Sadhus and other holy men gather — the sadhu akhadaas attracting a lot of curiosity — and regular people can meet them and learn from them.

#### How is the site of a Kumbh Mela decided?

This depends on astrological calculations. Another reason for the 12-year gap in Kumbh Melas is explained by the fact that Jupiter takes 12 years to complete on revolution around the Sun. According to the Kumbh Mela website, when Jupiter is in Aquarius or Kumbh rashi (whose symbol is the water bearer), and Sun and Moon in Aries and Sagittarius respectively, Kumbh is held at Haridwar.

When the Jupiter is in Taurus, and the Sun and Moon are in Capricorn or Makar (thus, Makar Sankranti is also in this period) the Kumbh is held at Prayag.

When Jupiter is in Leo or Simha, and the Sun and Moon in Cancer, the Kumbh is held at Nashik and Trimbakeshwar, which is why they are also called the Simhastha Kumbh.

#### Debate over Kumbh Mela's history

Many cite the Skanda Purana as proof of the Kumbh Mela's antiquity. Yet others mention the Chinese pilgrim Xuanzang (Hiuen Tsang) describing a fair in Prayag in the seventh century.

Professor Girija Shankar Shastri, head of Banaras Hindu University's (BHU) Department of Jyotish, said, "No scripture can be definitively said to contain a reference to the Kumbh Mela as we know it today. While the Samudra Manthan is described in many books, the spilling of amrita at four places is not. The Skanda Purana is widely cited to explain the origins of the Kumbh Mela, but those references have not survived in the extant versions of the Purana."

#### What pilgrims do at Kumbh

While some come for only one ritual dip in the river to wash away sins, many, termed kalpwasi, stay at the riverbank, to take a break from the daily fight of earning material resources and earn spiritual credit instead. Many give daan, or donations of various kinds, here.

With any large crowd comes the chance of commerce, and the Mela has also served as a market crucial to local communities. Historically, there are records of Venetian coins and European toys being spotted at the Mela markets.

The various sadhu akhadaas set up camp. They go for baths, called shahi snan, in elaborate processions. In the past, tussle over which sadhu akhadaa is important enough to bathe first has led to bloody battles, so now, an order is generally pre-decided.

Relevance: GS Prelims; Miscellaneous Source: Indian Express

3. PM Modi Inaugurates Z-Morh Tunnel in J&K

**Inauguration of Z-Morh Tunnel** 

Prime Minister Narendra Modi inaugurated the 6.5-km Z-Morh Tunnel in Sonamarg, Ganderbal, built at a cost of ₹2,700 crore. The tunnel enables year-round access to Sonamarg, transforming it into a round-the-year tourist destination.



### **Connectivity Projects in Jammu and Kashmir**

PM Modi emphasized the significant infrastructure developments in J&K, including:

• Z-Morh and Zojila Tunnels: These will connect Kashmir with Ladakh, easing travel for Kargil and Leh residents.

• Chenab Bridge: Recognized globally for its engineering marvel, with passenger train trials recently completed.

• Other Major Projects: ₹42,000-crore investments in connectivity, including the Katra-Delhi expressway, four national highways, two ring roads, and 14 additional tunnels.

#### **Tribute to Workers**

PM Modi honored the dedication of workers who endured harsh conditions and the risks of militant attacks, including the October 2024 attack that claimed seven lives at the construction site.

# Features of the Z-Morh Tunnel Strategic Importance

- Connects Gagangair to Sonamarg, bypassing the avalanche-prone Z-shaped road.
- Provides all-weather connectivity, cutting travel time to just 15 minutes.
- Along with the Zojila Tunnel, ensures uninterrupted access between Srinagar, Kargil, and Leh, vital for Indian military logistics.

## **Economic and Tourism Benefits**

• Boosts tourism in Sonamarg, known for attractions like the Thajiwas Glacier and Sind River rafting.

• Facilitates regional development, creating better connectivity and economic opportunities.

#### **Broader Tunnel Network**

The Z-Morh Tunnel is part of a larger initiative to construct 31 road tunnels (20 in J&K and 11 in Ladakh) with a combined investment of ₹1,400 billion (~US\$17.5 billion).

### **Advantages of the Tunnel**

1. All-Weather Accessibility: Eliminates road closures caused by snowfall and avalanches.

- 2. Reduced Travel Time: Significantly cuts journey duration between Srinagar and Leh.
- 3. Tourism Boost: Makes Sonamarg a year-round destination for tourists.

4. Enhanced Connectivity: Strengthens links across the region, benefiting both civilians and military operations.

Relevance: GS Prelims; Economics Source: The Hindu