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1. How and why US wants to establish a time standard for the Moon



Why in News?

Last week, the US White House officially directed the National Aeronautics and Space Administration (NASA) to create a time standard for the Moon, which different international bodies and private companies can use to coordinate their activities on the lunar surface.

But first, how does Earth's time standard work?

Most of the clocks and time zones — a geographical region which uses the same standard time — of the world are based on Coordinated Universal Time (UTC), which is set by the International Bureau of Weights and Measures in Paris, France. UTC is essentially internationally agreed upon standard for world time.

It is tracked by a weighted average of more than 400 atomic clocks placed in different parts of the globe. Atomic clocks measure time in terms of the resonant frequencies — the natural frequency of an object where it tends to vibrate at a higher amplitude — of atoms such as cesium-133. In atomic time, a second is defined as the period in which a caesium atom vibrates 9,192,631,770 times. As the vibration rates at which atoms absorb energy are highly stable and ultra-accurate, atomic clocks make for an excellent device for gauging the passage of time.

To obtain their local time, countries need to subtract or add a certain number of hours from UTC depending on how many time zones they are away from 0 degree longitude meridian, also known as the Greenwich meridian. If a country lies on the west of the Greenwich meridian, it has to subtract from the UTC, and if a country is located on the east of the meridian, it has to add.

Why do we need a time standard for the Moon?

UTC, however, cannot be used to determine time on the Moon. That is because time on the Moon flows differently than it does on the Earth.

A fundamental aspect of nature in the Universe is that time is not absolute. That seems crazy to us on Earth as our experience of time is that it just constantly ticks by. But if you travelled to the Moon, your clock would be ticking slightly faster than if you had stayed on the Earth. This is a consequence of [Albert] Einstein's Theory of General Relativity which tells us that

gravity bends space and time. As there is less gravity on the Moon, time ticks slightly faster there relative to the time on the Earth.

In other words, for someone on the Moon, an Earth-based clock will appear to lose on average 58.7 microseconds per Earth day with “additional periodic variations”.

The discrepancy may seem small but it can create problems for situations such as a spacecraft seeking to dock on the Moon, data transferring at a specific time, communication, and navigation.

Currently, handlers of each lunar mission use their own timescale that is linked to UTC. “Take the example of two spacecraft, NASA’s Lunar Reconnaissance Orbiter (LRO) and ISRO’s Chandrayaan 2 Orbiter, which orbit the Moon in roughly the same kinds of polar orbits that have some overlap. To ensure that they do not collide with each other — the probability of this happening is quite low but it can happen — the mission control teams of the two orbiters talk to each other, and they synchronise their mission operations standard with each other.

The approach can work for a handful of independent lunar missions, but issues will arise once there are multiple spacecraft working together at the same time — a situation which is bound to become a reality in the near future.

Several countries, including India, are looking to populate the Moon in the following years. While NASA’s Artemis program aims to send astronauts back to the lunar surface no earlier than September 2026, China has announced plans to land its astronauts by 2030, and India intends to arrive by 2040. There are also proposals to build a long-term human outpost on the Moon. Therefore, there is a need for a unified lunar time standard.

How will a lunar time standard be established?

The specifics for creating a time standard for the Moon are not clear yet. Like on the Earth, atomic clocks can be deployed on the lunar surface to set a time standard. There will be a need to place at least three atomic clocks on the lunar surface that will tick at the Moon’s natural pace, and whose output will be combined by an algorithm to generate a more accurate virtual timepiece.

Relevance: GS Prelims & Mains Paper III; Science & Technology

Source: Indian Express

2. What is GPT-4 Vision and how can it help you interpret images, charts?

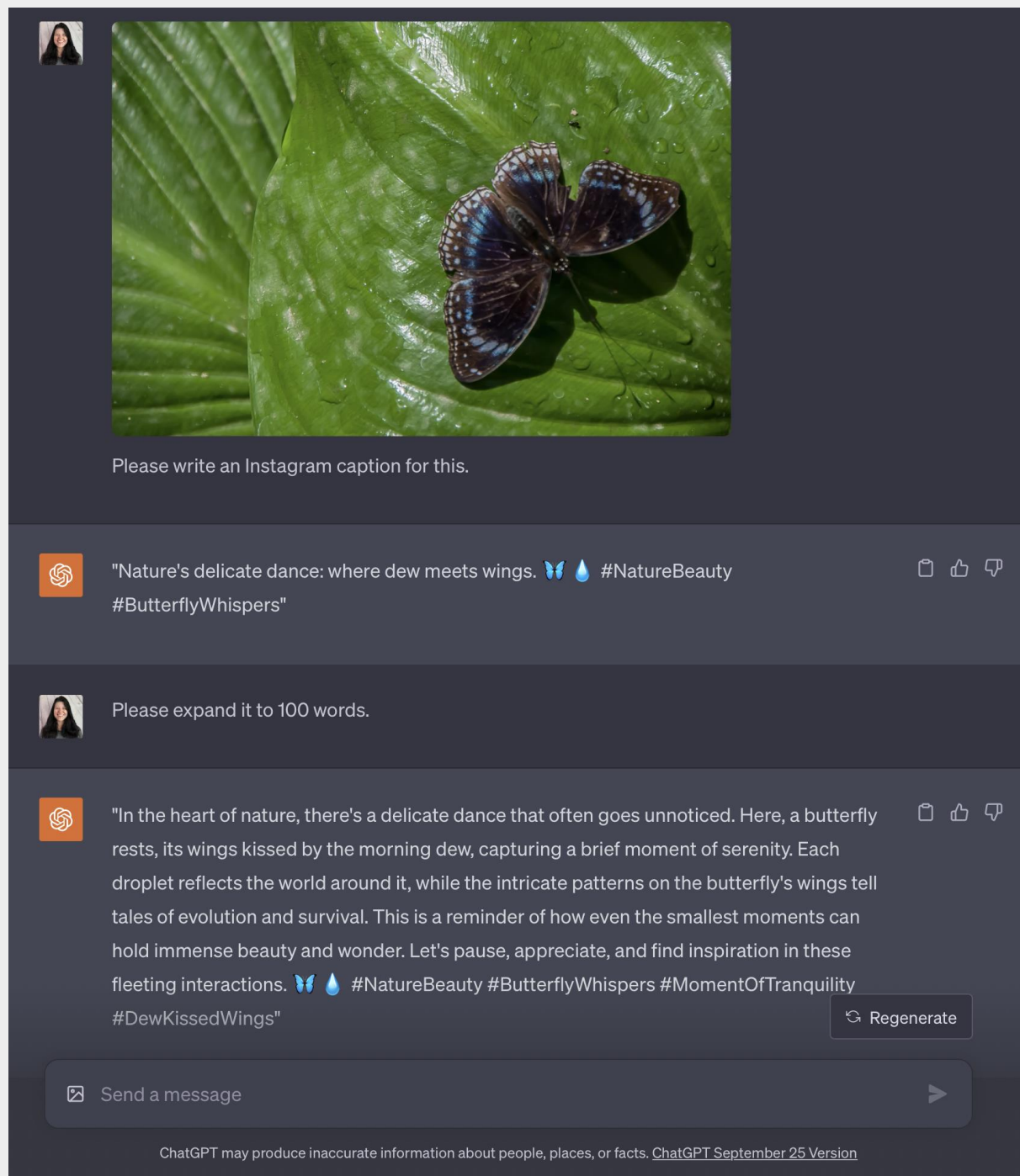
Why in News?

Following its launch, OpenAI’s ChatGPT has evolved by leaps and bounds — now churning text is not the only function, it can also create images from natural language prompts, thanks to the integration of DALL-E.

While image generation is one thing, there could be times when one wants to decipher an image of an old pamphlet, or a page from a book. Manually analysing the image may be difficult and time-consuming, and this is where GPT-4 Vision comes in handy.

What is GPT-4 Vision?

GPT-4 with Vision, also referred to as GPT-4V, allows users to instruct GPT-4 to analyse image inputs. GPT-4 Vision has been considered OpenAI's step forward towards making its chatbot multimodal — an AI model with a combination of image, text, and audio as inputs. It allows users to upload an image as input and ask a question about it. This task is known as visual question answering (VQA). GPT-4 Vision is a Large Multimodal Model or LMM, which is essentially a model that is capable of taking information in multiple modalities like text and images or text and audio and generating responses based on it. It is not the first and only LMM. There are many others such as CogVLM, LLaVA, Kosmos-2, etc. LMMs are also known as Multimodal Large Language Models (MLLMs).



The screenshot displays a chat conversation with GPT-4 Vision. It starts with a user request to write an Instagram caption for an image. The image shows a blue and black butterfly resting on a large green leaf with water droplets. The AI generates a caption: "Nature's delicate dance: where dew meets wings. 🦋💧 #NatureBeauty #ButterflyWhispers". The user then asks to expand it to 100 words. The AI provides a longer, more descriptive caption: "In the heart of nature, there's a delicate dance that often goes unnoticed. Here, a butterfly rests, its wings kissed by the morning dew, capturing a brief moment of serenity. Each droplet reflects the world around it, while the intricate patterns on the butterfly's wings tell tales of evolution and survival. This is a reminder of how even the smallest moments can hold immense beauty and wonder. Let's pause, appreciate, and find inspiration in these fleeting interactions. 🦋💧 #NatureBeauty #ButterflyWhispers #MomentOfTranquility #DewKissedWings". A "Regenerate" button is visible next to the second caption. At the bottom, there is a "Send a message" input field and a footer note: "ChatGPT may produce inaccurate information about people, places, or facts. ChatGPT September 25 Version".

Relevance: GS Prelims; Science & Technology
Source: Indian Express

3. Why Supreme Court's curative petition relief for Delhi Metro is significant

Why in News?

The Supreme Court ruled that the Delhi Metro Rail Corporation (DMRC) will not have to pay nearly Rs 8,000 crore to the Delhi Airport Metro Express Private Limited (DAMEPL), an Anil-Ambani owned Reliance Infrastructure company, which was awarded by a 2017 arbitral award. The ruling overturned the Supreme Court's September 2021 judgment that upheld the arbitral award. A month after the 2021 judgment, the court had dismissed a plea seeking a review — the final step in the appeal process after which a ruling of the highest court attains finality.

The court has now exercised its "extraordinary powers" in a curative writ petition to correct a "fundamental error" in its judgment.

JOURNEY OF THE DISPUTE



Reliance-led consortium had won the bid to operate the Airport Metro. *file*

2008: DAMEPL wins 30-year build, operate, transfer contract	MAR 2018: Single judge Delhi HC Bench refuses to interfere with arbitral award.
FEB 2011: Line becomes operational	JAN 2019: Two-judge Bench of the HC sets aside the arbitral award
APR 2012: DAMEPL seeks to delay payment to DMRC	SEPT 2021: Two-judge SC Bench restores arbitral award
OCT 2012: DAMEPL formally initiates termination of agreement	NOV 2021: SC dismisses review petition against its judgment
JUNE 2013: Arbitration proceedings begin	AUG 2022: Centre files curative petition
MAY 2017: Arbitration panel decides in favour of DAMEPL	APR 2024: SC restores 2019 HC ruling

History of the case

In 2008, the DMRC entered into a public-private partnership with DAMEPL, a consortium led by Reliance Infrastructure Ltd, for the construction, operation, and maintenance of the Delhi Airport Metro Express. While DMRC acquired the land and bore the cost of construction, the consortium was to design, install, and commission the railway systems in two years. Thereafter, until 2038, DAMEPL was to maintain the line and manage its operations, while paying a "concession fee" to DMRC.

However, a year after the line became operational, the consortium asked DMRC if it

could defer payment of the concession fee. Among the reasons cited were delays in providing access to the stations by DMRC, and that retail activity had not picked up on the line. This triggered a dispute between the consortium and the Union Ministry of Urban Development.

Subsequently, barely a year into its operations, the line was shut following a complaint from DAMEPL that it was "unsafe to operate". The consortium triggered a termination of its agreement alleging there were technical problems in the civil structure of the Metro corridor, for which DMRC was responsible as per the agreement.

Before operations were finally handed over to DMRC in June 2013, DAMEPL and DMRC made a joint application before the Commissioner of Metro Railway Safety for reopening the line. While the line started functioning again, the government and Reliance began a battle before an arbitration tribunal for losses due to cancellation of the agreement.

Rulings of courts

In 2017, the panel of three arbitrators decided in favour of Reliance and ordered DMRC to pay nearly Rs 8,000 crore. This included termination payment of Rs 2,782.33 crore, interest to the tune of 11%, bank guarantees, and expenses incurred in operating the Metro for a few months between the decision to terminate the agreement and the date on which operations were handed over to DMRC.

When the consortium sought to enforce the award, DMRC moved the Delhi High Court. A single judge Bench of the HC refused to interfere with the award, and directed DMRC to deposit 75% of the award in an escrow account.

The government then moved an appeal before a two-judge (division) Bench of the High Court. In 2019, the division Bench overturned the arbitral award, ruling in favour of DMRC. The Bench held that the tribunal had not considered some key facts, and had left some ambiguity in interpreting when the termination of the agreement took place.

This led DAMEPL to approach the Supreme Court against the High Court verdict. The SC heard the case, and in September 2021 reversed the HC verdict. A Bench comprising Justices L Nageswara Rao and S Ravindra Bhat underlined that courts must exercise restraint when interfering with arbitral awards.

This is crucial, since arbitration is an institutionalised alternative form of dispute resolution. It is devised and regulated by a 1996 statute to ensure speedy disposal of cases, especially commercial matters which suffer due to delays in the judicial system. The legislation and a plethora of SC judgments underline this aspect of minimum judicial interference with arbitral awards.

In November 2021, the SC dismissed a review petition against its judgment. Almost eight months later, DMRC filed a curative writ petition, the last resort to correct a judgment of the Supreme Court.

Curative jurisdiction

A curative writ petition as a layer of appeal against a Supreme Court decision is not prescribed in the Constitution. It is a judicial innovation, designed for correcting "grave injustices" in a ruling of the country's top court.

The SC first articulated the concept of a curative writ in *Rupa Ashok Hurra vs Ashok Hurra* (2002). If there was a significant miscarriage of justice due to a final decision of the Supreme Court, could the court still correct it? On one hand was the issue of finality and closure to a case, and on the other hand was the substantive question of rendering justice in its true sense. In answering this question, the SC said that its "concern for rendering justice in a cause is not less important than the principle of finality of its judgment".

However, curative writs are sparingly used. There are narrow, mostly procedural grounds that permit the filing of a curative writ. A claim must be made that principles of natural justice were not followed — for example, that a party was not heard, or that a judge was biased, or had a conflict of interest. These petitions need to be approved by a senior advocate designated by the court.

Curative writs are filed mostly in death penalty cases. The SC in the Yakub Memon case (2015) and the Delhi gang rape convicts case (2020) dismissed curative writs challenging death sentences. In 2023, in the Bhopal gas tragedy case, the SC refused to exercise its curative powers to enhance the compensation provided to victims that was deemed grossly inadequate.

After the judgment

The restoration of the 2019 position means that DMRC does not have to pay the arbitral award. About Rs 2,600 crore that DMRC had deposited with the High Court in an escrow account will be restored.

Allowing a curative petition at the government's instance almost two and a half years after its final verdict marks a significant moment in the way the court has exercised its vast powers. Lawmakers often argue for judicial restraint, especially with regard to the exercise of powers that the court has given to itself by going beyond the letter of the Constitution. While the government had high stakes in this case, such exercise of the curative jurisdiction could have a bearing on investor confidence.

Relevance: GS Prelims & Mains Paper II; Governance

Source: Indian Express