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1. IIT Madras Zanzibar: what does it mean to be an IIT outside India?

Why in news?

IIT Madras (IITM) Zanzibar, which was inaugurated last year, became part of household conversation after Amitabh Bachchan asked a participant in the game show Kaun Banega Crorepati where the first overseas campus of an IIT was located. What does it mean to be an IIT outside India?

History and context

The IITs were conceived and established as contributors to the human resource development of the nation. This is iterated in the "Indian" foundation of their name, the Indian institutes of Technology, and a sign in the main building of IIT Kharagpur that reads "Dedicated to the Service of the Nation" underscores this national imperative.

So, if IITs are territorial national expressions of postcolonial science, how do we reconcile the reality of the first offshore campus in Zanzibar?

Western and Indian

The Zanzibar campus of IIT Madras continues to be Indian, not African or Tanzanian. (Zanzibar is a Tanzanian archipelago in the Indian Ocean off the East African mainland.)

The first overseas campus is a declaration of aspiration by both IIT Madras and India as a nation to shoulder responsibility and share its success story.

On the day of the inauguration, November 6, 2023, Zanzibar's President Hussein Mwinyi described the campus as the high point of his term in office, and hoped that IITM Zanzibar would be a driver of economic change that would help the island achieve sustainable

development goals. He also said he expected the IITM campus to complement the nation's vision 2050 that requires skilled labour to transform the economy, and invited students from the entire region to utilise the opportunity presented by IITM.

Relevance: GS Prelims;
Source: The Indian Express

2. PM Modi to inaugurate BAPS temple in UAE

Why in News?
During his two-day visit to UAE, Prime Minister Narendra Modi will inaugurate the BAPS Swaminarayan temple in Abu Dhabi, the first Hindu temple in the Gulf nation.

The inauguration of the 108-ft high temple marks a significant moment for the Hindu community in UAE, as well as for the two countries' bilateral ties.

What is BAPS?
The temple has been built by the Bochasanwasi Akshar Purushottam Swaminarayan Sanstha (BAPS), a denomination of the Swaminarayan Sampradaya, a Vaishnav sect of Hinduism.

BAPS has a network of around 1,550 temples across the world, including the Akshardham temples in New Delhi and Gandhinagar, and Swaminarayan temples in London, Houston, Chicago, Atlanta, Toronto, Los Angeles, and Nairobi.

It also runs 3,850 centres and 17,000 weekly assemblies globally.

How did the demand for such a temple come up? Does Abu Dhabi have a big Swaminarayan community?
A BAPS spokesperson said Pramukh Swami Maharaj, the tenth spiritual guru and head of the sect, on April 5, 1997 had envisioned a Hindu temple in the desert sands of Abu Dhabi which could bring countries, communities and cultures together.

The Indian diaspora is almost 3.3-million strong in UAE, a huge percentage of the country's population. Of these, some 150 to 200 families are BAPS Swaminarayan devotees.

What are the features of the temple?
The Abu Dhabi temple is a traditional stone Hindu temple with seven shikhars. Built in the traditional Nagar style, the temple's front panel depicts universal values, stories of harmony from different cultures, Hindu spiritual leaders and avatars.

Spread over 27 acres, the temple complex is on 13.5 acres, with a parking area of 13.5 acres that can accommodate around 1,400 cars and 50 buses. The 13.5 acres of land was gifted by Sheikh Mohammed Bin Zayed Al Nahyan, the President of the UAE in 2019.

The height of the temple is 108 ft, length 262 ft and width 180 ft. While the external facade uses pink sandstone from Rajasthan, the interior uses Italian marbles. A total of 20,000 tonnes of stones and marble was shipped in 700 containers for the temple. More than Rs 700 crore was spent on the temple's construction.

The temple has two central domes, Dome of Harmony and Dome of Peace, emphasising human coexistence through the carvings of earth, water, fire, air, and plants.

A Wall of Harmony, one of the largest 3D-printed walls in the UAE, features a video showcasing key milestones of the temple's construction. The word 'harmony' has been written in 30 different ancient and modern languages.

The seven shikhars (spires) are representative of the seven Emirates of the UAE.
Other amenities include an assembly hall with a capacity of 3,000 people, a community centre, exhibitions, classrooms, and a majlis venue.

Relevance: GS Prelims
Source: The Indian Express

3. Why India wants to develop high-altitude pseudo-satellite vehicles, powered by the Sun

Why in news?
Last week, the Bengaluru-based National Aerospace Laboratories (NAL) successfully flew a prototype of a new-generation unmanned aerial vehicle (UAV) that is being seen as a huge technology breakthrough. It was no ordinary UAV. This one can fly at great heights, about 20 km from ground, runs entirely on solar power, and can remain in the air for months on end. Such UAVs belong to a class of flying objects called HAPS, or high-altitude pseudo-satellite vehicles, or HALE, that is high-altitude long-endurance vehicles.

The primary utility of HAPS vehicles is in the field of surveillance and monitoring, but there are other situations, like disaster management, wherein it can be very useful.

HAPS technology is still under development. Several countries, and companies, have developed and flown such vehicles with encouraging success, but none has mastered the

technology yet. The world record for a vehicle of this class is held by the Airbus-manufactured Zephyr, which flew continuously for 64 days in August 2022 before crashing.

The prototype tested by NAL last week spent eight and a half hours in the air. Next month, NAL, a unit of the Council of Scientific and Industrial Research (CSIR), plans to keep it in flight for at least 24 hours. The full-scale machine that NAL is trying to build, by 2027, would be aiming to remain in the air for 90 days at a stretch.

What is the need for such UAVs?

The kind of jobs that HAPS are meant to do are currently done by UAVs and satellites, but both have certain limitations. The normal UAVs, or drones as they are commonly called, are mostly battery-powered and cannot remain in the air beyond a few hours. Continuous monitoring is not something these can do very effectively. In addition, they fly at relatively low levels, because of which their vision is restricted to small areas.

Satellites can observe much larger areas, but the ones in low-earth orbits are continuously moving with respect to Earth. They cannot be constantly keeping an eye on the target area. Geostationary satellites, located at a height of about 36,000 km above the ground, can keep a constant gaze over one area. But these are fairly expensive, and once deployed, cannot be repurposed or reoriented.

HAPS are meant to overcome all these shortcomings, and do more.

Engineering challenges of HAPS

But developing an autonomous flying machine fuelled entirely by solar power and capable of remaining in the air for months faces major technological hurdles. That is the reason why, despite decades of work, a full-fledged HAPS vehicle has still eluded engineers. It is only now, with advanced technologies in solar cells, batteries and composite materials, that this vehicle looks possible in the near future.

The primary challenge is to generate enough solar power to keep the aircraft flying, the payloads operating, and the batteries charging. The batteries need to be enough to continue the operations through the night. Then there are design-related challenges. The aircraft needs to be extremely lightweight to minimise the power requirement, but it also has to be stable.

This is one of the reasons why this aircraft is meant to fly in the stratosphere. The region between 17 and 23 km above the earth's surface is climatologically conducive for their flight. The wind speed is very low and ideal for light-weight aircraft to remain stable. It helps that this height, much above the region in which civilian aircraft fly, is favourable for observation and surveillance activities.

But temperatures at that height can drop to -50 degree Celsius or lower. Electronics need to be kept warmer, and that is an additional burden on power resources. Also, air density is just about 7 per cent of what it is at sea level. That creates acute complications for the aircraft, for example in producing lift and thrust.

Because of limitations of space and weight, solar cells and batteries need to have very high efficiencies.

Relevance: GS Prelims & Mains Paper III; Science & Technology
Source: The Hindu