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Current affairs summary for prelims

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High Altitude Pseudo-satellite

Context: *The National Aerospace Laboratories (NAL) in Bengaluru achieved a significant technological breakthrough last week with the successful flight of a prototype for a next-generation unmanned aerial vehicle (UAV).*

Overview of HAPS (High-Altitude Pseudo-Satellite) UAVs:

- HAPS UAVs are capable of flying at great heights, around 20 km from the ground, operating entirely on solar power, and enduring flight for extended periods, potentially lasting months.
- Classified as either HAPS (High-Altitude Pseudo-Satellite) or HALE (High-Altitude Long-Endurance) vehicles, these UAVs are primarily utilized for surveillance and monitoring tasks, including disaster management scenarios.
- While HAPS technology is still in development, several countries and companies have made significant progress in developing and testing such vehicles. However, mastering the technology remains a challenge, with the world record for continuous flight held by Airbus's Zephyr at 64 days in August 2022.

Achievements and Future Goals:

- NAL (National Aerospace Laboratories) recently tested a prototype HAPS UAV, achieving an eight and a half-hour flight duration.
- NAL plans to extend the flight duration to 24 hours next month and aims to develop a full-scale HAPS UAV capable of remaining airborne for 90 consecutive days by 2027.

Need for HAPS UAVs:

- The role intended for HAPS UAVs is currently performed by traditional UAVs and satellites, each with its own limitations.
- While traditional UAVs are mostly battery-powered and have limited flight durations, satellites, especially those in low-earth orbits, cannot provide continuous monitoring due to their continuous movement. Geostationary satellites offer constant observation but are costly and lack flexibility.
- HAPS UAVs aim to overcome these limitations by providing continuous monitoring capabilities while being more cost-effective and flexible than traditional satellites.

Advantages and Capabilities of HAPS UAVs:

- HAPS UAVs, operating at stratospheric altitudes, move at slow speeds, enabling detailed and continuous observation over large areas.
- With resolutions as high as 15 cm per square km, they offer superior monitoring capabilities compared to traditional UAVs and satellites.
- Additionally, HAPS UAVs provide flexibility and reusability, allowing for easy redeployment to different locations or reequipping with different payloads.

Engineering Challenges:

- Developing autonomous HAPS UAVs powered entirely by solar energy presents significant technological hurdles.
- Challenges include generating sufficient solar power to sustain flight and payload operations, ensuring battery capacity for nighttime operations, and balancing lightweight design with stability.

Applications of HAPS (High-Altitude Pseudo-Satellite) UAVs:

- **Weather Monitoring and Earth Imaging**: HAPS can serve as atmospheric satellites for weather monitoring and earth imaging at a fraction of the cost of orbital satellites. They offer potential applications in oceanography, disaster response, and agricultural observation.
- **Radiocommunication Services:** In Europe, HAPS are being considered to deliver high-speed connectivity over areas up to 400 km, providing bandwidth and capacity similar to broadband wireless access networks. They could enhance military communications in remote regions with challenging terrain.
- **Surveillance and Intelligence:** UAVs like the Northrop Grumman RQ-4 Global Hawk are utilized by the US Air Force for surveillance and security purposes. Equipped with radar, optical, and infrared imagers, these UAVs can transmit real-time data.
- **Real-time Monitoring:** HAPS can facilitate real-time monitoring for flood detection, seismic activity tracking, remote sensing, and disaster management.
- **Weather and Environmental Monitoring**: High-altitude balloons deployed by HAPS can carry scientific equipment for environment and weather monitoring, assisting in measuring environmental changes and tracking weather patterns. NASA, in collaboration with NOAA, employs Global Hawk UAVs for studying Earth's atmosphere.
- **Rocket Launch Support**: HAPS platforms situated above 90% of atmospheric matter can reduce atmospheric drag for rocket launches. Launching rockets from a high-altitude platform could potentially increase their altitude significantly. Additionally, mass drivers have been proposed for launching payloads into orbit from HAPS

Directly synthesising Carbon nanotubes (CNTs) on Glass substrates

Context: *A new method for synthesizing Carbon nanotubes (CNTs) directly on glass substrates at 750 °C could benefit energy research, biomedicine, and optoelectronics.*

Carbon Nanotubes (CNTs) in Modern Technology:

- CNTs exhibit extraordinary properties and are used in various fields such as rechargeable batteries, flexible electronics, aerospace, transparent electrodes, touch screens, supercapacitors, and medicine.
- Traditional CNT synthesis methods require high temperatures (~1000°C) and metal catalysts (Fe, Co, Ni), posing biocompatibility concerns and adding significant costs due to catalyst removal.

Innovative CNT Synthesis Method by IASST:

- Researchers at the Institute of Advanced Study in Science and Technology (IASST) have developed a novel method for synthesizing CNTs directly on glass substrates at 750°C.

- The method utilizes the Plasma Enhanced Chemical Vapour Deposition Technique (PECVD) with a specially designed spiral-shaped fused hollow cathode source.
- This approach eliminates the need for high temperatures and metal catalysts, making it cost-effective compared to conventional methods.

Key Factors Influencing CNT Growth:

- Factors such as plasma characteristics, substrate composition, substrate temperature, and plasma pre-treatment significantly influence CNT growth.
- Pre-plasma treatment of the glass substrate at elevated temperatures enhances surface area, exposing more constituent elements and promoting CNT growth.
- Sodium (Na) emerges as the primary catalyst for initiating CNT growth, and its removal from as-grown CNTs is facilitated by washing with deionised water.

Carbon Nanotubes (CNTs): CNTs are carbon structures with nanometer-scale diameters and micrometer-scale lengths, featuring seamless cylindrical graphene sheets rolled into cylinders with nanometer-sized diameters.

Properties of Carbon Nanotubes:

1. **Electrical Conductivity:** CNTs exhibit high electrical and thermal conductivity along with exceptional mechanical strength. Arrays of multi-walled CNTs, known as CNT forests, can be drawn into continuous length webs with electrical conductivity.
2. **Strength and Elasticity:** Carbon nanotubes are renowned for their exceptional tensile strength and stiffness, making them one of the strongest and stiffest materials known.
3. **Thermal Conductivity and Expansion:** The rigid carbon bonds facilitate the transmission of vibrations, leading to excellent heat conductivity. CNTs have high melting points due to strong covalent bonds between carbon atoms. Delocalized electrons within the tube enable CNTs to conduct electricity effectively.
4. **Electron Emission:** Each carbon atom in CNTs is connected to three others by strong covalent bonds, resulting in high melting points and the presence of spare electrons. This creates a sea of delocalized electrons within the tube, facilitating electrical conduction.

Applications of Carbon Nanotubes:

- CNTs find applications in diverse fields such as energy storage, device modelling, automotive components, boat hulls, sports equipment, water filtration, thin-film electronics, coatings, actuators, and electromagnetic shielding.
- Their large surface area makes CNTs suitable for adsorbing or conjugating medicinal and diagnostic substances in pharmaceutical and medical applications.
- Unique chemical, size, optical, electrical, and structural properties make CNTs attractive for drug delivery, biosensing platforms, and noninvasive monitoring of human body chemistry.

Report by the Parliamentary Standing Committee on Rural Development and Panchayati Raj

Context: *A report from a Parliamentary Standing Committee indicates that only 3% of MNREGA job seekers received unemployment benefits.*

Overview of Unemployment Benefits under MGNREGA:

- Under the Mahatma Gandhi National Employment Guarantee Act (MGNREGA), labourers are entitled to unemployment benefits if they do not find work within 15 days of seeking employment.
- The benefits include a daily unemployment allowance, which is one-fourth of the wage rate for the first 30 days of the financial year and half of the wage rate thereafter.

Discrepancy in Benefit Distribution:

- Despite 7,124 workers being eligible for unemployment benefits over the last five years, only 258 received them, indicating a mere 3% distribution rate.
- A report by the Parliamentary Standing Committee on Rural Development and Panchayati Raj highlighted this issue.

State-Specific Data:

- Karnataka had the highest number of eligible workers (2,467) for unemployment benefits, but none received them.
- Rajasthan followed with 1,831 eligible workers, of which only nine received benefits.
- Bihar, West Bengal, Jharkhand, and Uttar Pradesh also showed significant discrepancies between eligible workers and actual benefit recipients.

Responsibilities of State Governments:

- State governments are responsible for providing unemployment allowance based on their economic capacity and must make necessary budgetary provisions for it.
- The committee recommended that the Central Rural Development Department ensure coordination with states and Union Territories to ensure fulfillment of statutory obligations regarding unemployment benefits.

Steps Taken and Further Action:

- The Department of Rural Development (DoRD) pledged to address the issue of non-payment of unemployment allowance and compensation for delayed wages.
- MGNREGA also stipulates compensation for delayed wage payments, which the panel requested information on.
- The committee was informed of a significant outstanding amount of compensation for late payments, indicating the need for further action and clarification on responsibility for payment.

NEWS IN BETWEEN THE LINES

Kawal Tiger Reserve

Recently, six forest staff members faced suspension due to negligence in controlling teak smuggling within the Kawal Tiger Reserve.

About Kawal Tiger Reserve:

- Kawal Tiger Reserve is a **nature preserve** in the Jannaram mandal of Mancherial District in Telangana.
- The reserve is the oldest sanctuary and located **on the banks of the Godavari river**.
- It was established in **1999** and declared a tiger reserve by the government of India in **2012**.
- **Flora:** Kawal Tiger Reserve's flora, in Deccan Plateau Zone VI, consists of Southern **Tropical Dry Deciduous Forest** with **teak**, **bamboo** and over 673 plant species.
- **Fauna:** Kawal Tiger Reserve exhibits diverse **Deccan Plateau fauna**, including mammals like **nilgai**, **chinkara** and **carnivores** such as tiger, **leopard** and jungle cat.

Shrimad Rajchandra Mission

Recently, the President of India visited the Shrimad Rajchandra Mission Dharampur, Valsad of Gujarat.

About Shrimad Rajchandra Mission:

- The Shrimad Rajchandra Mission Dharampur **is a spiritual movement** that aims to **help people realize their true selves and serve others selflessly.**
- It was founded in **1994** by **Pujya Gurudevshri**, a devotee of Shrimadji.
- The movement is headquartered in Dharampur, Gujarat and has **108 centers across five continents.**
- The movement's **goal is to achieve inner transformation through meditation, wisdom and service.**

Shrimad Rajchandra (11 November 1867-9 April 1901)

- Shrimad Rajchandra (Shri Raichandbhai Ravjibhai Mehta), a **Jain poet, philosopher, scholar, reformer** was born in Vavaniya, **Saurashtra**.
- He advocated for women's education and empowerment through works like **"Stri Niti Bodhaka."**
- His authored works like "**Sad-bodh-shatak**" (**1884**) addressing ethical topics and moral principles.
- He composed numerous bhajans and poems, some of which, like "**Apurva Avsar Evo Kyare Aavshe," were revered by Gandhi** and included in Ashram **Bhajanavali**.
- He compiled and published "**Shrimad Rajchandra Vachanamrut,"** a collection of his complete works, including letters and writings.

NATO

Recently, former US President Donald Trump has raised a criticism by suggesting he wouldn't defend NATO allies who failed to spend enough on defence and would even encourage Russia to attack them.

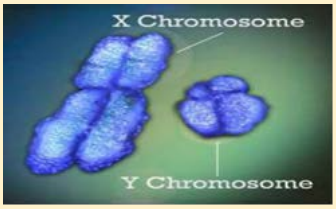
About NATO:

- NATO (**North Atlantic Treaty Organization**) was **founded in 1949 during the Cold War** to counter the Soviet Union's influence.
- It is **political and military alliance** of countries from North America and Europe.
- It currently **comprises 31 members**, including **European nations**, **the United States** and **Canada** and Finland is the newest member, joining in April last year.
- NATO members have **committed to spending at least 2% of their GDP annually on defense** but most members did not meet this goal last year.

NATO's Article 5:

- **Article 5 of the NATO treaty** states that an attack on any member shall be considered an attack on all.
- **It allows for collective defense measures,** including the use of armed force.

X-Inactive Specific Transcript



Recent studies suggest that XIST may elicit inflammatory immune responses and serve as a target for autoantibodies, contributing to autoimmune diseases' pathogenesis.

About X-Inactive Specific Transcript:

- XIST (X-Inactive Specific Transcript) is a **long non-coding RNA molecule** crucial for the process of **X-chromosome** inactivation in females.
- It coats one of the two X chromosomes in females, leading to its inactivation by attracting proteins that suppress gene expression.
- It wraps around the inactive X chromosome, **attracting chromatin-modifying proteins** that alter its structure and gene accessibility, thereby silencing gene expression.
- XIST-mediated X-chromosome inactivation is essential for normal development and cellular function in females by **balancing gene dosage between males and females.**
- **Dysregulation** or mutations in XIST can lead to various diseases, including **autoimmune disorders** due to altered gene expression patterns.

Place in News

Estonia

Recently, Russia declared Estonian leader Kaja Kallas and other European officials as “wanted” over their alleged involvement in the destruction of Soviet-era war memorials.

Estonia (Capital: Tallinn)

Location: Estonia, officially known as **the Republic of Estonia**, is a country in the **Baltic region** of Northern Europe.

Boundaries: Estonia shares its border with **Lake Peipus and Russia** (East), **the Baltic Sea** (West), **the Gulf of Finland** (North) and **Latvia** (South).

Physical Features:

- **Suur Munamagi** is the highest point in Estonia.
- The **Emajogi**, the **Parnu** and the **Poltsamaa** are the prominent rivers in the country.
- Estonia is an important **producer of oil shale**.

Membership: Estonia is a member of various international organizations, including the **European Union** (EU), **NATO** (North Atlantic Treaty Organization) and the **United Nations** (UN).

POINTS TO PONDER

- Which state is associated with Nazool Land, recently highlighted in the news? **- Uttarakhand**
- In which state is Kawal Tiger Reserve located, as mentioned in recent news? **- Telangana**
- In which city of India was the 'Dakshin Bharat Sanskritik Kendra' established, as reported recently? **- Hyderabad**
- UPI payment system has been recently launched in which two countries? **- Sri Lanka and Mauritius**
- What is 'Alaskapox', a term recently in the news? **- DNA virus disease**