



19 April, 2024

Indigenous Technology Cruise Missile (ITCM)

Context: On April 18, 2024, DRDO successfully flight-tested the Indigenous Technology Cruise Missile (ITCM) from Chandipur's Integrated Test Range (ITR) off the Odisha coast.

- All subsystems performed as expected during the test.
- Range Sensors including Radar, Electro Optical Tracking System (EOTS), and Telemetry deployed by ITR ensured complete coverage of the flight path.
- Monitoring of the missile's flight was conducted from an Indian Air Force Su-30-Mk-I aircraft.
- The missile successfully followed its intended path using waypoint navigation and showcased very low altitude sea-skimming flight.
- Advanced avionics and software were integrated into the missile to enhance performance and reliability.
- Developed by the Bengaluru-based DRDO laboratory Aeronautical Development Establishment (ADE) in collaboration with other laboratories and Indian industries.

Aspect	Cruise Missile	Ballistic Missile
Functionality	Guided towards preset land-based targets using navigation system	Generally shot up into the atmosphere
Altitude and Mobility	Low altitude flight with high mobility	Launched outside the atmosphere, warheads detach to hit target
Range	Shorter ranges (300 to 1000 km)	Longer ranges, up to 1000 km (ICBMs can reach 5000 km)
Interceptibility	Easier to intercept due to high terminal speeds	Difficult to intercept due to high terminal speeds (up to 5000 m/s)
Precision	High precision due to navigation system	Lower precision
Cost	Cheaper, suitable for firing conventional warheads	More expensive, suitable for firing nuclear warheads
Example	BrahMos (290 to 450 km), Nirbhay (700 to 1000 km)	Agni V (5000 km), Intercontinental Ballistic Missiles (ICBMs)
Flight Path	Follows preset path with waypoint navigation	Traces parabolic path outside atmosphere
Guidance System	Relies on navigation system for guidance	Uses inertial guidance system and may include GPS
Terminal Speed	Terminal speeds typically lower	Terminal speeds can reach up to 5000 m/s
Targeting	Can be used for pinpoint targeting	Often used for strategic targeting of large areas
Warhead Types	Can carry conventional and sometimes nuclear warheads	Primarily used for nuclear warheads
Vulnerability	More susceptible to interception due to slower speeds	More difficult to intercept due to high speeds
Maneuverability	Capable of performing evasive maneuvers	Limited maneuverability during re-entry phase

Cruise missiles of India

➤ Nirbhay Cruise Missile:

- Range: 750-1000 km
- Weapon Payload: 500 kg

➤ Characteristics:

- First indigenously developed long-range cruise missile flying at low altitudes
- Will arm the army, navy, and air force
- Speed: Subsonic speeds of 0.7 Mach
- Capable of flying at tree-top altitudes as low as 10 m (now tested for 5 m)
- Can deliver nuclear warheads of 200-300 kg
- 2-stage solid-fuelled cruise missile
- Terrain-hugging and sea-skimming capabilities make it hard to detect by enemy radars

➤ BrahMos Cruise Missile:

- Range: 290 km (extended to 450 km after India's full membership in MTCR)
- Weapon Payload: 300 kg

➤ Characteristics:

- Joint venture between India and Russia
- Speed: Top speed of 2.8 Mach
- Operates on a fire-and-forget principle
- Can be launched from land, water, and air

➤ BrahMos NG (Next Generation):

- Low weight air-launched version capable of being carried by Light Combat Aircraft, Tejas LCA

➤ BrahMos II Hypersonic Cruise Missile:

- Range: 290 km
- Weapon Payload: 300 kg
- Speed: 6 Mach

Fall in Private Investments in India

Context: The slow increase in private investment, measured by private GFCF as a percentage of current GDP, is a major issue for the Indian economy.

➤ Definition of GFCF and its Significance:

- GFCF represents the growth in the size of fixed capital in an economy, including investments in buildings and machinery.
- It serves as an indicator of the willingness of the private sector to invest in the economy.
- Fixed capital formation, facilitated by GFCF, enhances economic growth and living standards by increasing the production capacity of an economy.

➤ Trends in Private Investment in India:

- Private investment in India witnessed significant growth post the economic reforms of the late-1980s and early-1990s.
- Historically, public investment exceeded private investment until the early 1980s, after which private investment gained prominence.
- However, since 2011-12, private investment has declined steadily, reaching a low of 19.6% of GDP in 2020-21.

➤ Reasons for the Decline in Private Investment:

- Low private consumption expenditure has been attributed as the primary reason for the sluggish private investment.
- Some economists argue that structural problems, including unfavourable government policies and policy uncertainty, are major hindrances to private investment.
- While increased government investment may compensate for low private investment, it can also

Face to Face Centres





19 April, 2024

crowd out private investment and lead to inefficiencies.

➤ **Impact of Low Private Investment:**

- Slower economic growth is the most significant consequence of low private investment, as a robust fixed capital base is crucial for economic expansion.
- Government investment, while potentially offsetting private investment, may not efficiently allocate capital compared to private investors.
- Taxes levied to fund public spending can also pose a drag on the economy and deter private investment.

Dragonfly Mission

Context: NASA confirmed the Dragonfly mission to Saturn's moon Titan, with a \$3.35 billion budget and a launch set for July 2028.

➤ **Dragonfly Mission Overview:**

- Dragonfly is a NASA spacecraft mission aimed at sending a robotic rotorcraft to Titan, Saturn's largest moon.
- The mission is scheduled to be launched in July 2028 and is expected to arrive at Titan in 2034.
- It will be the first aircraft to explore Titan and is designed to conduct powered and fully controlled atmospheric flights, focusing on studying prebiotic chemistry and extraterrestrial habitability.

➤ **Significance of Titan:**

- Titan is recognised for its abundant, complex, and diverse carbon-rich chemistry, making it a high-priority target for astrobiology and origin of life studies.
- The surface of Titan is dominated by water and ice, with evidence of an interior water ocean, further enhancing its significance for scientific exploration.

➤ **Mission History:**

- Dragonfly was proposed to NASA's New Frontiers program in April 2017 by the Johns Hopkins Applied Physics Laboratory (APL).

- It was selected as one of two finalists out of twelve proposals in December 2017 and officially selected as the fourth mission in the New Frontiers program on June 27, 2019.
- The mission underwent preliminary design review in March 2023 and faced a launch delay to July 2028 due to funding uncertainties in November 2023.

➤ **Mission Design and Construction:**

- Dragonfly is designed as a rotorcraft lander, resembling a large quadcopter with double rotors known as an octocopter.
- It will utilise a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) for power generation, rechargeable during Titan's night.
- The craft is equipped with a suite of scientific instruments, including DraMS (Mass Spectrometer) and DragonCam (Camera Suite), to assess Titan's microbial habitability and study its surface composition.

➤ **Scientific Objectives:**

- Dragonfly aims to explore diverse locations on Titan's surface to characterise its habitability and investigate the progress of prebiotic chemistry.
- It will study areas where extraterrestrial liquid water and organic compounds may interact, potentially providing insights into the origins of life.

➤ **Trajectory and Landing Site:**

- The mission is expected to launch in July 2028 and will take approximately seven years to reach Titan.
- Dragonfly will undergo entry and descent using an aeroshell and parachutes, landing initially in dunes southeast of the Selk impact structure.
- It plans to explore this region and later travel to the Selk impact crater to study its geological features and potential cryovolcanism.

NEWS IN BETWEEN THE LINES

Aryabhata Satellite

On April 19, 1975, India achieved a significant milestone in its space exploration journey with the successful launch of its first satellite, 'Aryabhata', into space.

About Aryabhata Satellite:

- The Aryabhata satellite was India's first artificial satellite, launched on April 19, 1975.

Face to Face Centres





19 April, 2024



- The satellite was built by the **Indian Space Research Organisation (ISRO)** and named after the **5th century Indian astronomer and mathematician Aryabhata**.
- The satellite was **launched from the Volgograd Launch Station**, which is now in Russia, by a **Soviet Kosmos-3M rocket**.
- The chairman of the Indian Space Research Organisation at the time of the launch of Aryabhata was **Satish Dhawan**.
- The two other Indian satellites launched onboard Soviet rockets, featured on the postage stamp issued by the **USSR in 1984** along with Aryabhata, were **Bhaskara-I and Rohini-I**.
- The area on the outskirts of Bengaluru selected by U.R. Rao as the location for the Indian Scientific Satellite Project, where **Aryabhata was built, is Peenya**.
- The city from which there was strong opposition to moving equipment for building Aryabhata to the new Bengaluru facility was Ahmedabad.
- The other two options recommended for the satellite's name were "**Jyoti**" and "**Bhaskara**".

Avian Flu/ Influenza



The Animal Husbandry Department in Kerala recently announced plans to cull around 21,000 ducks in avian flu-affected areas of Kuttanad, Alappuzha district, targeting hotspots like Edathua and Cheruthana.

About Avian Flu/ Influenza:

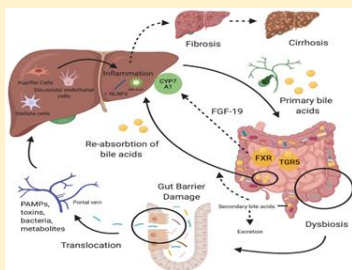
- Avian influenza, **also known as bird flu**, is a disease caused by a virus that primarily affects birds.
- It spreads between wild and domesticated birds and from birds to humans who are in close contact with **poultry or other birds**.
- The most likely way for a human to **catch bird flu** is through exposure to birds, bird faeces or feathers.
- Symptoms in people can range from **mild upper respiratory tract infection** (fever and cough) to severe pneumonia, **acute respiratory distress syndrome** (difficulty breathing), shock and even death.
- Most **bird flu viruses don't infect humans**, but there are four strains that have caused concern in recent years: **H5N1** (since 1997), **H7N9** (since 2013), **H5N6** (since 2014), and **H5N8** (since 2016).
- Avian influenza is different from pandemic flu, which is human flu that would affect millions of people all around the world.

Today, on World Liver Day, the symbiotic relationship between the liver and the gut was emphasized.

About the Liver-Gut Axis:

- The liver-gut axis refers to the **bidirectional communication system between the liver and the gut**.
- The **liver detoxifies harmful substances**, synthesizes essential **proteins**, stores **glycogen** and **metabolizes nutrients**, regulating **blood sugar** and **cholesterol levels**.
- The gut hosts trillions of microorganisms collectively known as the **gut microbiota**, which **aid in digestion, synthesis of vitamins** and **support the immune system**.
- Bile produced by the liver aids in fat digestion and acts as a signaling molecule in the gut, affecting the composition of the gut microbiota.
- **Metabolites produced by gut bacteria** can influence liver metabolism and inflammation, contributing to overall health.
- A healthy gut microbiome **contributes to the integrity of the gut barrier**, preventing harmful substances from entering the bloodstream and burdening the liver.
- Modern lifestyles characterized by processed foods, **antibiotics** and **chronic stress** can **disrupt the delicate balance of the liver-gut axis**, leading to gastrointestinal disorders and liver diseases.
- **Embracing a fiber-rich diet, incorporating probiotic-rich foods, limiting sugar** and processed foods, staying hydrated, and managing stress are crucial strategies to optimize liver-gut health.

Liver-Gut Axis



Face to Face Centres





19 April, 2024

Place in News

Burkina Faso

Recently, Burkina Faso expelled three French diplomats over alleged "subversive activities," declaring them "persona non grata."

Burkina Faso (Capital: Ouagadougou)

Location: Burkina Faso is a **landlocked country** located in West Africa.

Political Boundaries: Burkina Faso shares its borders with **Niger** (Northeast), **Mali** (Northwest), **Togo and Ghana** (South), **Benin** (Southeast), and **Ivory Coast** (Southwest).

Physical Features:

- The highest point in Burkina Faso is **Tenakourou**, also known as Mount Tenakourou.
- Burkina Faso is traversed by several rivers, including the **Volta**, **Black Volta** (Mouhoun), **White Volta** (Nakambe) and **Red Volta** (Nazinon).
- Burkina Faso is rich in various minerals, including **gold, manganese, limestone, phosphates, salt** and **zinc**.
- Burkina Faso experiences a **tropical climate**.

International Relations: Burkina Faso maintains diplomatic relations with various countries and is a member of regional organizations such as the **Economic Community of West African States (ECOWAS)** and the **African Union (AU)**.



POINTS TO PONDER

- Which organisation recently developed a Carbon-Carbon (C-C) nozzle for rocket engines? – **ISRO**
- What is the GDP growth projection of India for FY 2024-25 according to IMF? – **6.8%**
- By which year has ISRO decided to achieve a debris-free space? – **2030**
- What is 'Gaia-BH3', recently in the news? – **Massive stellar black hole**
- Where was the first international workshop on 'Emerging Technologies and Challenges for Exoskeleton' organised by DRDO held? – **Bengaluru**

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