NEXT IAS

DAILY NEWS ANALYSIS

18th July

Explained

1. Swachh Survekshan” survey-2025
2. Missile Test : Akash Prime, Agni &Prithvi
3. Automotive Mission Plan 2047
4. Urja Vrat-2025

Decoded

5. Axiom 4 Mission

Playlist Link:

What to Read: https://bit.ly/3FYdutC

Daily News Analysis: https://bit.ly/4ge9BgF

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"Swachh Survekshan" survey-2025

Ahmedabad cleanest big city in India: survey

The Hindu Bureau
NEW DELHI

Ahmedabad was named the cleanest big city in India, followed by Bhopal and Lucknow, in the Centre's annual "Swachh Survekshan" cleanliness survey.

Indore, Surat, Navi Mumbai, and Vijayawada were among 23 cities that entered the newly introduced "Super Swachh League", which recognises sustained excellence in cleanliness among cities, in the "million-plus population" category.

President Droupadi Murmu gave away the "Swachh Survekshan 2024-25" awards to the winners on Thursday.

Noida, Chandigarh, and Mysore, among others, entered the league in the "3 to 10 lakh population" category while New Delhi made the cut in the "50,000 to 3 lakh population" category of the league.

This year's awards introduced the "Swachh Shahar", or Clean City category, , in which Ahmedabad, Bhopal, and Lucknow secured top three positions in the list of cities with a population of more than 10 lakh. In the "3-10 lakh population" group, Mira-Bhayandar of Maharashtra topped the list, followed by Bilaspur (Madhya Pradesh) and Jamshedpur.

NDMC recognised for cleanliness in Swachh Survekshan awards

The Hindu Bureau
NEW DELHI

The MCD secured the 31st position among 40 cities with a population of more than 10 lakh

The New Delhi Municipal Council (NDMC) on Thursday received the 'Super Swachh League City' award at the Swachh Survekshan 2024-25 awards ceremony held at Vigyan Bhawan.

The body was recognised for its performance in urban sanitation and waste management in the category of cities with a population between 50,000 and 3 lakh.

"This award is a testament to NDMC's continued efforts to set benchmarks in cleanliness and civic excellence," said NDMC chairman Keshav Chandra.

The primary goal of the cleanliness survey, which was started in 2016, is to encourage large-scale citizen participation and create awareness about urban cleanliness. This year, the Union Housing and Urban Affairs Ministry introduced a special category, 'Super Swachh League', to recognise cities demonstrating exceptional performance in sanitation.

Meanwhile, the Municipal Corporation of Delhi (MCD) was ranked 31 out of 40 cities with a population of over 10 lakh, ahead of Greater Mumbai and Chennai, which were ranked 33 and 38 respectively.

Ghaziabad fared better than the MCD and stood at 11th position.

In the category of cities with a population of 3 lakh to 10 lakh, Noida received the 'Super Swachh League City' award, while Gurugram was ranked 41.

Backdrop: Swachh Survekshan Awards: Indore, Surat, and Navi Mumbai ranked among India's cleanest cities.
Relevance: GS 1- Society

About the news

- **Ahmedabad** was declared the **cleanest city** among cities with **a population of over 10 lakh**.
- A total of **4,589 urban local bodies (ULBs)** participated in the **9th edition** of the Swachh Survekshan survey, conducted between **April 2024 and March 2025**.
- It is conducted annually under the **Swachh Bharat Mission (Urban)** by the **Ministry of Housing and Urban Affairs (MoHUA)** to evaluate urban sanitation and cleanliness.
- The "Swachh Survekshan" survey, which is the world's largest urban sanitation and cleanliness survey, was **launched in 2016.**

New Features & Format of the 2024–25 Survey

- A **revamped format** was introduced to encourage newer cities and recognize consistent performers differently.
- The new **“Super Swachh League Cities”** category was created to group cities that had been **top 3 consistently for the past 3 years**.
- Cities like **Indore**, which have topped the rankings multiple times, were shifted to this new league to **promote competitive fairness**.

Key Winners & Special Awards

Million-Plus Population Category (Population >10 lakh)

- **Top 3 Clean Cities**:
  - Ahmedabad
  - Bhopal
  - Lucknow

Super Swachh League Cities (Top Performers Over 3 Years)

- Indore
- Navi Mumbai
- Surat

Cleanest Ganga Town

- **Prayagraj** – recognized for maintaining cleanliness along the **Ganga River** under the **Namami Gange programme**.

Cleanest Cantonment Board

- **Secunderabad Cantonment** – awarded as the cleanest among military-administered urban zones.

Safaimitra Surakshit Shehar Awards

- These cities excelled in **manual scavenging elimination**, **safety of sanitation workers**, and **mechanised cleaning**:
  - Visakhapatnam
  - Jabalpur
  - Gorakhpur

Special Initiative

- **Swachh Mahakumbh 2025** – special mention for large-scale cleanliness drive linked to mass religious gatherings.

Population-Based City Categories Introduced

To ensure fair assessment, cities were grouped by population size:

Category	Population Range
Very Small Cities	Less than 20,000
Small Cities	20,000 – 50,000
Medium Cities	50,000 – 3 lakh
Big Cities	3 lakh – 10 lakh
Million Plus Cities	More than 10 lakh

Survey Focus & Evaluation Parameters

- The 2024–25 survey assessed cities on **10 thematic indicators** covering:
  - Sanitation infrastructure
  - Waste management (collection, segregation, disposal)
  - Urban cleanliness, hygiene
  - Behavioral change and citizen feedback
- **Special emphasis** was laid on:
  - **Tourist destinations** and **high-footfall public places**.
  - Promoting **Reduce, Reuse, Recycle (3R)** principles, in line with the **Jaipur Declaration of the 3R Forum 2025**.

PRACTICE QUESTION

Q1. Who conducts the Swachh Survekshan survey under the Swachh Bharat Mission (Urban)?

(a) Ministry of Jal Shakti

(b) Ministry of Environment, Forest and Climate Change

(c) Ministry of Housing and Urban Affairs

(d) NITI Aayog

Missile Test: Akash Prime, Agni &Prithvi

Backdrop: The Army successfully tested the indigenous Akash Prime air defence system in Ladakh.
Relevance: GS 3- Defence

Akash Prime successfully tested in Ladakh by Army

Saurabh Trivedi
NEW DELHI

To further strengthen the air defence system, the Army has carried out successful trials of the indigenously developed air defence system "Akash Prime" in Ladakh.

A senior official confirmed that the Army Air Defence Corps conducted the trials in collaboration with senior scientists from the Defence Research and Development Organisation (DRDO), which developed the missile system.

The two-day trial was conducted at an altitude of over 15,000 feet in eastern Ladakh. The Akash Prime scored two direct hits on fast-moving aerial targets in the rarefied high-altitude atmosphere.

On top: The Army carried out successful trials of the indigenously developed air defence system in Ladakh. X/DRDO

The latest version of the Akash system would form the third and fourth regiments of the Akash air defence systems in the Indian Army. The Akash air defence system is a medium-range, surface-to-air missile platform.

Prithvi-II and Agni-I

The Ministry of Defence on Thursday confirmed that short-range ballistic missiles – Prithvi-II and Agni-I – were successfully test-fired from the Integrated Test Range in Chandipur, Odisha.

The launches validated all operational and technical parameters. These tests were conducted under the aegis of the Strategic Forces Command, added the Ministry.

About the news

Akash Prime missile, which is the upgraded variant of Akash weapon for the high altitude region, was successfully tested in Ladakh on Wednesday .

Overview of Akash Prime Trial

- **Purpose**: Strengthen India's air defence capability, especially in high-altitude regions.
- **Location**: Conducted in eastern **Ladakh** at an altitude of **15,000+ feet**.
- **Outcome**: Two **direct hits** on fast-moving aerial targets confirmed successful testing.
- **Trial Type**: First Production Model firing trial.

Development & Collaboration

- **Developed by**: DRDO (Defence Research and Development Organisation).
- **Collaborators**: Army Air Defence Corps, DRDO scientists, Bharat Dynamics Ltd, Bharat Electronics Ltd, and other defence PSUs.
- **User Feedback Based Enhancements**: Incorporated recommendations from the Indian Armed Forces.

Features & Advancements of Akash Prime

- **Type**: Upgraded **surface-to-air missile** system (SAM), medium-range.
- **Range & Altitude**:
  - Operational Range: **27–30 km**
  - Maximum Altitude: **~18 km**
- **New Addition**: **Indigenous Active RF (Radio Frequency) Seeker** → improves **target lock accuracy**.
- **Environmental Suitability**:
  - Optimised for **cold weather and high-altitude** operation (above 4,500 m).
  - Enhanced **performance under low-temperature** conditions.

Radar Sensor Vehicle (3D CAR)

Specifications

RADAR COVERAGE

Azimuth coverage	:	0°- 360 °
Elevation coverage	:	30° with manual tilt -2° to +1°
Height coverage	:	30 m to18 km
Range	:	4 km - 150 km for 2m^2 target

DETECTION PERFORMANCE

Detection range for fighter aircraft	:	150 km for 7.5 rpm for 2 m^2 target and120 km for 15 rpm for 2 m^2 target
Detection range for UAV	:	60 km
Detection probability	:	0.9 for 2 m^2 target
False alarm probability	:	1 x 10^{-6} for 2 sq m target

ACCURACY

Range	:	50 m
Azimuth	:	Better than ± 0.5^0
Elevation	:	5 millirad upto 100 km

RESOLUTION

Range resolution	:	200 m
Azimuth	:	3°

TARGET TRACKING

Target speeds	:	80 kmph to 3500 kmph
TWS	:	Automatic initiation and maintenance upto 150 tracks
RDP capability	:	To handle up to 2000 plots per scan
Heading accuracy	:	± 5° for speed ≥ 300 kmph ± 10° for speed ≤ 300 kmph
Speed accuracy	:	± 50 kmph
Target maneuver	:	Can handle up to 6g turn
Processing delay	:	Not more than 1 scan + upto 2 sec in turn
False tracks	:	Less than 1 per minute in non- ECM environment
Track crossing	:	Can resolve crossing tracks, if difference in radial speeds is greater than 50 m/s

3D Central Acquisition Radar-Akash is medium range 3D-surveillance Radar mounted on a mobile platform and designed to meet the operational requirements of Indian Defence. The radar is capable of detection, tracking of air targets upto 150 km in range. The antenna is rotated mechanically in azimuth to provide coverage of 360^0. The Radar can be operated at 15 RPM and 7.5 RPM. The range figures are quoted for a $P_d = 0.9$ and $P_{fa} = 1x10^{-6}$ and target cross-section of 2 m^2.

The antenna design is such that it provides for elevation coverage of 30^0. The antenna can be manually positioned at different look angles. In the receive mode, the seven beams cater for a height coverage of 15 km and elevation coverage of 30°. The azimuth beam width of the radar is 1.8. This provides for an azimuth resolution of better than 3.0° and accuracy of 0.5°.

भारत इलेक्ट्रॉनिक्स
BHARAT ELECTRONICS

Operational Significance

- **Formations**: Will form the **3rd and 4th regiments** of Akash systems in the Indian Army.
- **Targets**: Designed to destroy **high-speed unmanned aerial targets**.
- **Use-case**: Meant to **protect critical installations** and **vulnerable areas**.
- **ECCM Capabilities**: Built-in **Electronic Counter-Counter Measures** to resist jamming/deception.
- AKASH Weapon System can simultaneously engage Multiple Targets.
- The entire weapon system has been configured on mobile platforms.
- AKASH Weapon Systems has been inducted and is operational with the Indian Air Force (IAF) as well as the Indian Army (IA).

Historical Context

- **Origin**: Part of **Integrated Guided Missile Development Programme** started in the **late 1980s**.
- **Trials**: Early trials in the 1990s and 2000s → extensive **user trials by Indian Air Force and Army**.
- **Name**: *Akash* means **"Sky"** in Sanskrit → Symbolizes **aerial deterrence**.

Strategic Relevance

- **High-Altitude Defence**: Enhances air defence on **Himalayan borders**.
- **Indigenisation**: Boosts India's **Atmanirbhar Bharat** initiative in defence tech.
- **Export Potential**: Strong interest in Indian missile systems in **global defence markets**.
- **Follows**: Successful use of indigenous missiles in **Operation Sindoor**.

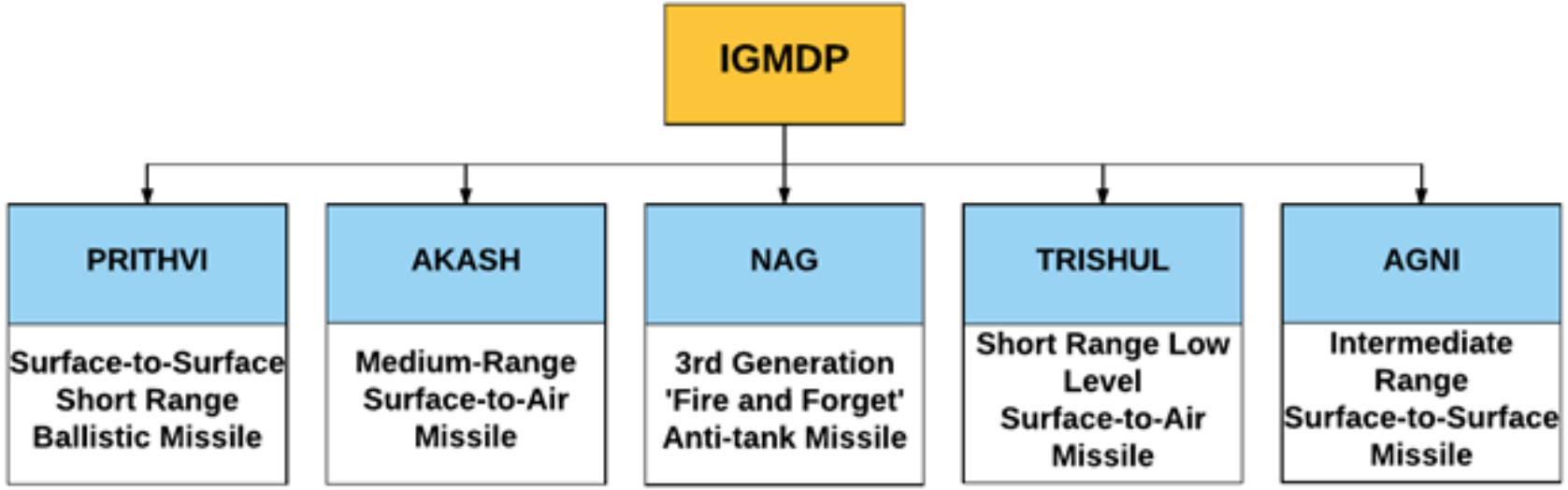
Related Tests

- Alongside Akash Prime:
  - **Prithvi-II** and **Agni-I** ballistic missiles also tested from **Chandipur, Odisha**.
  - Conducted under the **Strategic Forces Command**.

Prithvi-II Missile:

- **Type**: Nuclear-capable, surface-to-surface short-range ballistic missile.
- **Warhead Capacity**: Can carry 500–1,000 kg warheads.
- **Propulsion**: Powered by twin liquid-fuel engines.
- **Range**: Has a strike range of 350 km.

- **Accuracy**: Equipped with an advanced inertial guidance system and maneuvering trajectory for high precision.
- **Induction**: Inducted into Indian Armed Forces in 2003.
- **Development**: Among the first missiles under India's Integrated Guided Missile Development Programme (IGMDP).



Agni-I Missile:

- **Development & Testing**: Development began in 1999; first successful test in 2003; regularly tested by Strategic Forces Command.
- **Deployment**: Inducted into the Indian Army's Strategic Forces Command in 2007.
- **Type**: Nuclear-capable ballistic missile.
- **Propulsion**: Single-stage, solid-fuel missile with a booster derived from ISRO's SLV-3.
- **Range**: 700 km with heavy payload; up to 1200 km with lighter payloads.
- **Launch Platforms**: Can be launched from both rail-based and road-mobile TELs(transporter erector launchers).

Countries Engaged /Interested in Akash Missile System

- **Vietnam** – Has shown interest as part of deepening defense ties with India to counterbalance China in the Indo-Pacific.
- **Philippines** – Explored possible acquisition of Akash missiles; India already signed a BrahMos deal with them.
- **Armenia** – Already purchased Indian defense systems (like Pinaka); may explore Akash as part of future defense diversification.

- **Indonesia, UAE, Bahrain, Egypt** – Have been in discussions for Indian air defense systems including Akash.

Note: India cleared the export of Akash in 2021 and created a committee to facilitate its export to friendly countries.

- **Agni-I and Prithvi-II Missiles** are **nuclear-capable strategic weapons** under India's **Strategic Forces Command**, forming part of the country's **credible minimum deterrence**.
- **Not intended for export**, both are restricted under **MTCR** and **international non-proliferation norms** due to their strategic and nuclear roles.

Strategic Forces Command (SFC)

It is a tri-services military command established in **2003** to manage and operationally control **India's nuclear weapons arsenal**. It is responsible for the deployment, readiness, and use of **strategic (nuclear) delivery systems**, and functions under the **Nuclear Command Authority**, chaired by the **Prime Minister of India**.

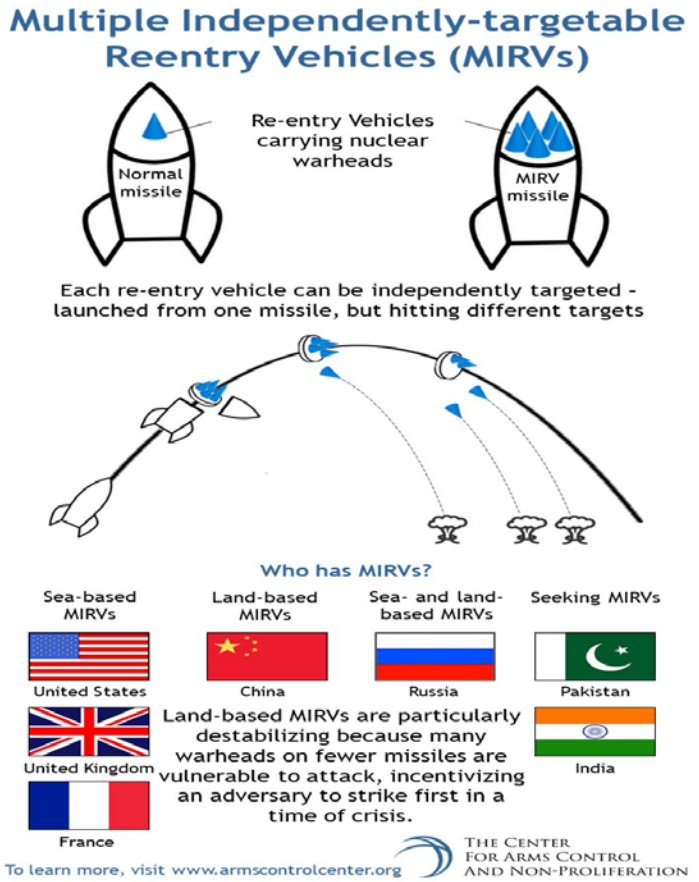
Strategic Importance of Integrated Test Range (ITR)

- **Strategic Coastal Location:** Situated near the Bay of Bengal, enabling safe over-water missile tests and reducing land-based risk.

- **Dual Launch Capability:** Hosts launch complexes on both mainland and Abdul Kalam Island for testing varied missile systems.
- **Robust Infrastructure:** Features advanced launch pads, mission control centers, block houses, radars, and telemetry stations.
- **Versatile Testing Range:** Capable of testing various missile types with ranges up to 1200 km.
- **Core DRDO Facility:** Acts as a major R&D hub for DRDO's missile development and refinement programs.

Multiple Independently Targetable Re-entry Vehicle (MIRV) Technology

- **Revolution in Missile Payloads**: MIRV technology transformed ballistic missile systems by allowing a single missile to carry and deploy multiple warheads, each aimed at separate targets.
- **Origin & Deployment**: The United States pioneered MIRV with the Minuteman III test in 1968, operationalizing it by the 1970s. The Soviet Union followed with MIRV-equipped ICBMs(Intercontinental Ballistic Missiles) and SLBMs(submarine-launched ballistic missiles) by the late 1970s.
- **Operational Range & Flexibility**: Warheads can be released at different speeds and directions, with some MIRVs capable of striking targets up to 1,500 km apart.



PRACTICE QUESTION

Q2. Consider the following statements regarding the Akash Missile System:

1. It is a short to medium-range surface-to-air missile developed by DRDO.
2. The Akash Prime variant is equipped with an indigenous active radar seeker for improved accuracy.
3. Akash missile system is capable of operating at high altitudes and in low-temperature environments.

Which of the statements given above is/are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Automotive Mission Plan 2047

Ministry of Heavy Industries

The Ministry of Heavy Industries has initiated the Automotive Mission Plan 2047 (AMP 2047), a strategic roadmap aligned with the 'Viksit Bharat @2047' vision to advance India's automotive sector

The Sub-Committees for AMP 2047 convened to outline objectives and initiate deliberations

The initiative involves various ministries, industry bodies (SIAM, ACMA, CII), academia, and testing agencies for an industry-led effort

AMP 2047 targets increasing India's global automotive trade share, focusing on innovation and sustainability

Posted On: 17 JUL 2025 4:30PM by PIB Delhi

The Ministry of Heavy Industries, Government of India, under the visionary leadership of Prime Minister Shri Narendra Modi, and with the guidance of Minister for Heavy Industries and Steel Shri H.D Kumaraswamy has initiated the formulation of the Automotive Mission Plan 2047 (AMP 2047), a strategic roadmap aligned with the 'Viksit Bharat @2047' vision. Building on the achievements of previous Automotive Mission Plans, which promoted the significant growth in India's automotive sector through stakeholder collaboration, AMP 2047 aims to enhance innovation, global competitiveness, and sustainable development to establish India as a global automotive leader by 2047.

The inaugural meeting of the AMP 20247 Sub-Committees was held to outline the objectives and framework. Additional Secretary, MHI, Dr. Hanif Qureshi, highlighted the initiative's significance, stating, "The vision for 2047 is not an aspiration but a strategic roadmap backed by concrete targets for sector growth, exports, and industry advancement. We must think beyond specific technologies or companies and focus on India's global standing in 2047, aiming to increase our share in global automotive trade through innovation and quality."

The meeting convened representatives from various ministries, including the Ministry of Power, Ministry of Road Transport and Highways, Ministry of Commerce, Ministry of Petroleum and Natural Gas, DPIIT, Ministry of Environment Forest and Climate Change and industry bodies such as SIAM, ACMA, and CII, FICCI, academic institutions, research think tanks and testing agencies, initiating an industry-led effort to shape AMP 2047.

Backdrop:The Sub-Committees for AMP 2047 convened to outline objectives and initiate deliberations.
Relevance: GS 3-Infrastructure

About the news

The Ministry of Heavy Industries has initiated the Automotive Mission Plan 2047 (AMP 2047), a strategic roadmap aligned with the 'Viksit Bharat @2047' vision to advance India's automotive sector.

What is AMP(Automotive Mission Plan) 2047?

- **AMP 2047** is a **strategic roadmap** launched by the **Ministry of Heavy Industries**.
- It aligns with the national vision of **'Viksit Bharat @2047'**, which aims to make India a **developed nation** by 2047.
- The plan builds upon the successes of earlier Automotive Mission Plans.

Objectives of AMP 2047

- To establish India as a **global leader in the automotive sector** by 2047.
- To **increase India's share** in **global automotive trade**.
- To **foster innovation**, sustainability, and quality in the Indian automotive industry.
- To strengthen India's position through **concrete targets** for sector growth and exports.

Stakeholders Involved

- AMP 2047 is an **industry-led initiative** involving:
  - **Central ministries**: Power, Road Transport & Highways, Commerce, Petroleum, DPIIT, Environment.
  - **Industry bodies**: SIAM (Society of Indian Automobile Manufacturers), ACMA (Automotive Component Manufacturers Association), CII, FICCI.
  - **Academia and research think tanks**.
  - **Testing agencies** and **OEMs** (Original Equipment Manufacturers).

Sub-Committee Structure

- **Seven Sub-Committees** have been formed.
- These include experts from **government, industry, and academia**.
- They will design **milestones** for the years **2030, 2037, and 2047**.
- Sub-committees will submit findings and data to an **Apex Committee** chaired by the Secretary of the Ministry of Heavy Industries.

Key Focus Areas

- **Technological advancements** (like EVs, AI in vehicles, etc.).
- Development of **charging infrastructure** and other mobility ecosystems.
- Ensuring **sustainability** and **self-reliance** in the automotive sector.
- Addressing **policy and regulatory frameworks** to enable innovation and ease of business.

Broader Vision

- AMP 2047 is not just a sectoral roadmap but a **national vision to uplift India's industrial ecosystem**.
- It aims for a **holistic transformation** involving **sustainability, economic growth, and global integration**.

Indian Automotive Landscape

- 4th largest vehicle producer globally (after China, USA, Japan).
- Annual production: ~6 million vehicles.
- Strong presence in **small cars** and **utility vehicles**.
- Backed by **Make in India** and a **cost-effective workforce**, India is emerging as a manufacturing and export hub.

Emerging Trends in the Sector

- **Electric Vehicles (EVs):**
  - Rapid shift due to **sustainability demands**, **carbon emission norms**, and **battery advancements**.
  - New global supply chains for **lithium, cobalt** and **battery manufacturing** (especially in Europe & US).
- **Industry 4.0 & Digital Tech:**
  - Use of **AI, ML, IoT, and robotics** in auto manufacturing.
  - Enables **smart factories**, **connected vehicles**, better productivity, and cost reduction.
  - Supports **new business models** and innovation-driven growth.

Challenges to India's Global Participation

- Low share in global auto component exports (~3%).
- Other Challenges include:
  - High operational costs
  - Infrastructure gaps
  - Limited integration into GVC(Global Value Chain)
  - Inadequate R&D investments

PRACTICE QUESTION

Q3. With reference to the Automotive Mission Plan 2047 (AMP 2047), consider the following statements:

1. It is a strategic roadmap formulated by the Ministry of Road Transport and Highways.
2. The plan aligns with the Viksit Bharat @2047 vision.
3. It aims to increase India's share in global automotive trade and promote sustainability.

Which of the statements given above is/are correct?

(a) 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 1, 2 and 3

Urja Vrat-2025

Ministry of Petroleum & Natural Gas

Azadi Ka Amrit Mahotsav

India Charts Bold Upstream Energy Strategy at Urja Varta 2025

Minister Puri Highlights Reforms, Diversification, and Global Collaboration for a Secure Energy Future

Our states are the core of India's energy transformation and transition: said Shri Puri

Posted On: 17 JUL 2025 6:40PM by PIB Delhi

Minister of Petroleum and Natural Gas Minister Puri laid out India's comprehensive strategy for strengthening upstream exploration and production (E\&P), energy resilience, and international cooperation while speaking in a fireside chat session organised on sidelines of Urja Varta 2025.

Backdrop: Recently, the 2nd edition of **Urja Varta 2025** was held in **New Delhi**,
Relevance: GS 3/Energy

About the news

The second edition of **Urja Varta 2025** was held at **Bharat Mandapam, New Delhi**, bringing together **over 700 participants,** including ministers, officials, industry leaders, and experts.

Organised by the **DGH** under the **MoPNG**, the event focused on India's upstream oil and gas sector.

With the theme **"Collaborate, Innovate, Synergize,"** the conclave served as a dynamic platform for dialogue, technical exchange, and strategic visioning around India's energy roadmap.

Key Highlights

- **Major Launches**
    - Revised **Petroleum and Natural Gas Rules (PNG Rules 2025)** and the **Model Revenue Sharing Contracts (MRSC)** to enhance policy clarity, boost investor confidence, and further Ease of Doing Business.

- Commencement of **Hydrocarbon Resource Assessment Studies** using globally benchmarked methodologies to better estimate India's resource base.

- Release of **India Hydrocarbon Outlook 2024–25,** the 32nd edition of DGH's flagship report, which provides data-driven insights for shaping future E\&P strategies and investment decisions.

Other reforms in recent years

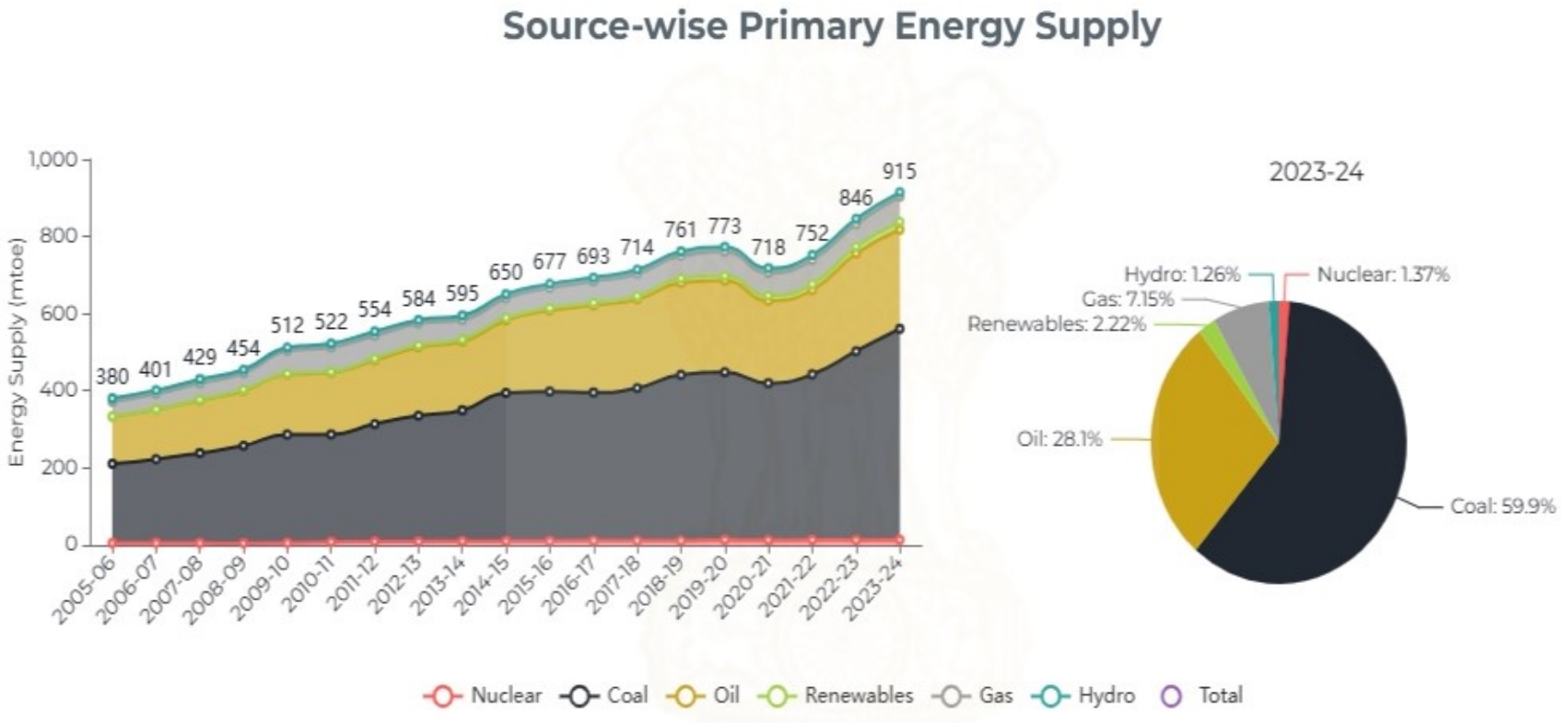
- Reimagined exploration framework under the **Oilfields Regulation and Development Act (ORDA)**
  - Co-designed approach
  - Single lease and approval mechanism,
  - Transparent operational rules
  - Introduction of a "no-sit" clause to eliminate inactive acreage.

Progress in recent years:

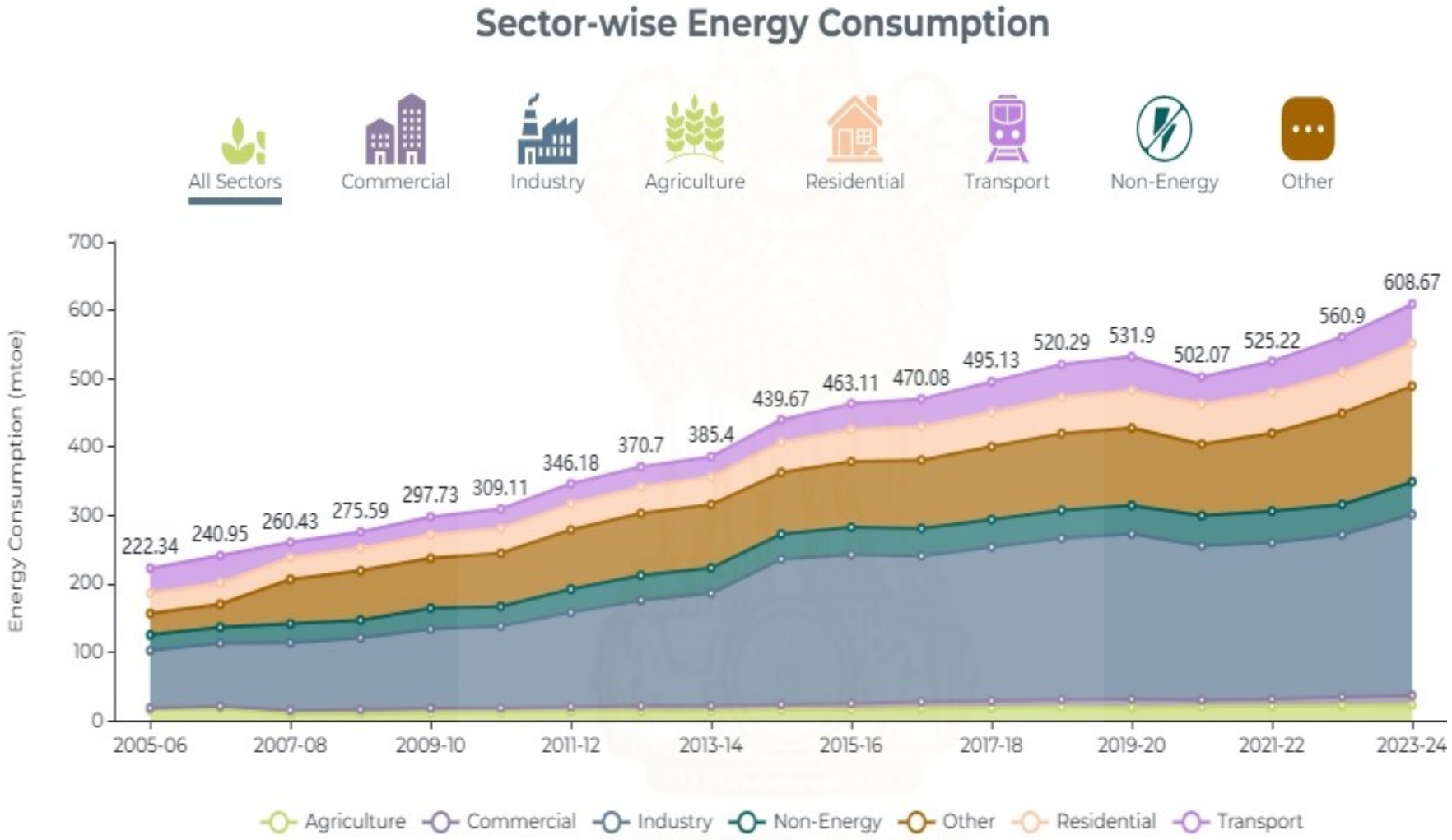
- The policies have ensured the opening of nearly **1 million square kilometres** of previously inaccessible **"No-Go" areas** to explore, thereby unlocking significant resource Potential.

- **₹4 lakh crore** invested over the past decade in energy infrastructure and **₹30–35 lakh crore** expected by 2035 across the hydrocarbons value chain.
- India contributed **16% to global oil demand growth** in the last 5 years and is projected to contribute **25% of future global demand** till 2045.

India's Energy Basket



Energy Consumption



India’s Oil & Gas Sector in FY25

Imports & Dependency

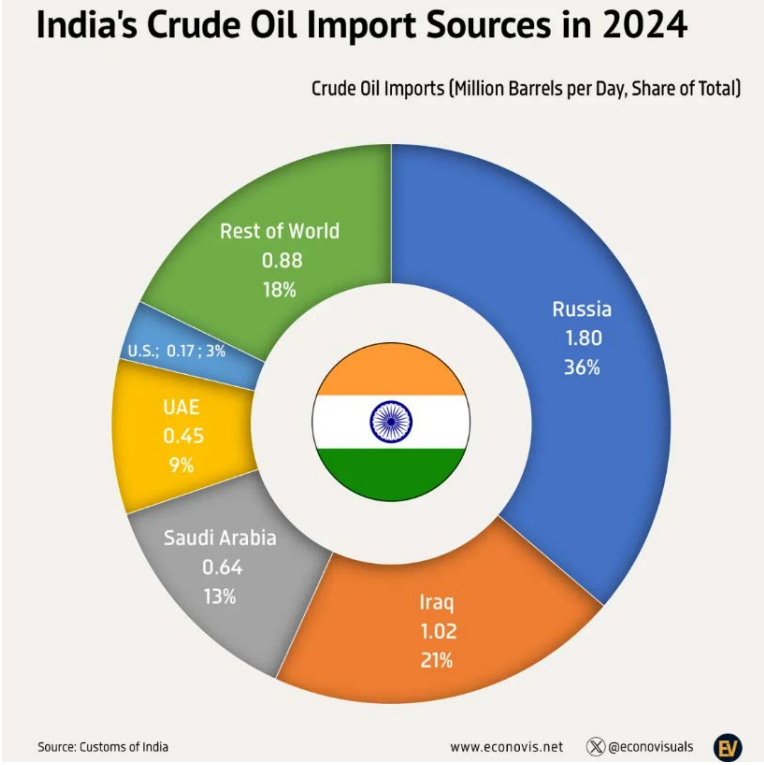
- **Crude oil imports** rose by **4.2%** to **242.4 million tonnes (MT)** (from 232.7 MT in FY24).
- **Import dependency** increased slightly from **88.6%** (March 2024) to **89.1%** (March 2025).
- **Import bill** rose from **$156.3 billion** in FY24 to **$161 billion** in FY25.

Gas Imports vs Production

- **Gas imports** increased **15.4%** to **36,699 MMSCM**.
- **Domestic gas production** declined by **0.9%** to **36,113 MMSCM**.
- **Crude oil production** also fell to **28.7 MT** (from 29.4 MT).

Crude Oil Prices

- India’s crude oil basket price dropped from **$84.49/barrel (Mar 2024)** to **$72.47/barrel (Mar 2025)**.
- This **$12/barrel drop** helped moderate the import bill despite higher volumes.



Consumption Trends

- **Total petroleum consumption** rose **2.1%** to **239.2 MT**.
  - High-speed diesel**:** +2.0%
  - Petrol**:** +7.5%
  - **LPG:** +5.6%

Exports

- Petroleum, oil, and lubricants (POL) product **exports** increased by **3.3%**.
- Driven by higher exports of:
  - **Motor Spirit (gasoline)**
  - **Petcoke**
  - **Fuel oil**

India’s Crude Oil Imports

Main sources: Iraq, Saudi Arabia, Russia, and the United Arab Emirates.

Import for the years 2022–23 and 2023–24:

Year	Crude Oil Imports (MMT)	Import Bill (USD Billion)
2022–2023	232.7	157.5
2023–2024	232.5	132.4

PRACTICE QUESTION

Q4. With reference to India's Oil & Gas Sector in FY25, consider the following statements:

1. India's crude oil import volume increased compared to FY24.
2. Domestic production of both natural gas and crude oil witnessed a rising trend compared to the previous year.
3. Exports of petroleum, oil, and lubricants (POL) products decreased compared to FY24.

Which of the statements given above is/are correct?

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) All of the above

NASA-Axiom-ISRO tie-up

Stepping stone

The NASA-Axiom-ISRO tie-up is an admirable outcome

A crew of four astronauts including India's Shubhanshu Shukla completed their roughly two-week mission to the International Space Station on July 15. Mr. Shukla's trip was presumed to have been an intensive rehearsal ahead of his flight as part of India's first batch of astronauts for ISRO's 'Gaganyaan' mission, currently expected in 2027. The presumption is because the goals of Mr. Shukla's trip, which ISRO arranged for by paying north of ₹500 crore to Axiom Space, have not been officially communicated by Indian authorities. Fortunately, clarifications from Axiom and NASA have since cast more light on its purpose. While ISRO and the Department of Space are still expected to proactively disseminate what they know about their activities under Gaganyaan, not least because of the mission's ₹20,000 crore price tag, Mr. Shukla's trip ought to strengthen ISRO's preparations. Human spaceflight is a highly involved endeavour: once in space, the crew is on its own and the resources to respond to a variety of situations are limited. According to a statement ISRO published after the mission launched on June 25, Mr. Shukla and Prasanth Nair – who is also part of Gaganyaan's first cohort of astronauts and was part of the Axiom mission's backup crew – were familiarised with "advanced spacecraft systems, emergency protocols, scientific payload operations, microgravity adaptation, space medicine, and survival traits". As the mission pilot, per Axiom, Mr. Shukla was also coached on docking and undocking, manual operations, atmospheric reentry, and anomaly management. Onboard the space station, Mr. Shukla was exposed to operations in the Japanese and European modules, for which he and Mr. Nair were trained in Japan and Germany. ISRO Chairman V. Narayanan has also said that the Axiom mission cost less than what ISRO might have had to invest if it had to train Mr. Shukla on its own. In all, the NASA-Axiom-ISRO tie-up emerges as an admirable outcome, even as space agencies continue to closely guard space technologies for their strategic value.

Concerns that the limitations imposed by the U.S.'s International Traffic in Arms Regulations would prevent the duo from learning much may also be laid to rest. Instead, they may be replaced by concerns about ISRO's piecemeal communication. Astronauts cut inspirational figures and appeal to all ages. As India prepares for its first human spaceflight mission, there can be no better way to build excitement than by facilitating access to India's astronauts. The lack of initiative is hard to rationalise, although it is still not too late. ISRO as well as India's soft power platform will make copious gains by expanding outreach and easing public access to the spacefarers.

Backdrop: Return of Indian astronaut Group Captain Shubhanshu Shukla from the International Space Station

Relevance: GS 3/Space

About the news

- Indian astronaut **Group Captain Shubhanshu Shukla** returned to Earth on **July 15, 2025,** after completing the **Axiom-4 mission**, spending 18 days on the **International Space Station (ISS)**.
- He orbited Earth **288 times** and conducted **over 10 scientific experiments**, marking a significant step for India in **human spaceflight and space research**.

Return to Earth

- A day before returning, the **Crew Dragon 'Grace'** carrying Shubhanshu Shukla and his three Axiom 4 crewmates **undocked from the ISS** at an altitude of 400 km.
- After **orbiting Earth for about 22 hours**, the spacecraft re-entered the atmosphere, withstood intense heat, and **safely splashed down off the coast of California** at around **24 km/h**, marking the **successful end of Shukla's first space mission**.

Axiom Mission 4 (Ax-4)

Axiom Mission 4 (Ax-4) marks the fourth private astronaut flight to the **International Space Station (ISS)**, coordinated by **Axiom Space** in partnership with **NASA**, **SpaceX**, and **ISRO**.

INTERNATIONAL SPACE STATION

Largest modular space station in low Earth orbit, also the largest human-made structure in space

Launched on

20 November, 1988 from Kazakhstan

Mission Life

It is expected to operate till 2030.

Orbit

It orbits LEO of earth at an average altitude of 400 km and circles the globe every 90-93 minutes

Size

Weighs almost 450 tonnes

Agencies Involved

- USA - NASA
- EUROPE - ESA
- JAPAN - JAXA
- CANADA - CSA
- RUSSIA - ROSCOSMOS

Components

Station is divided into two sections:

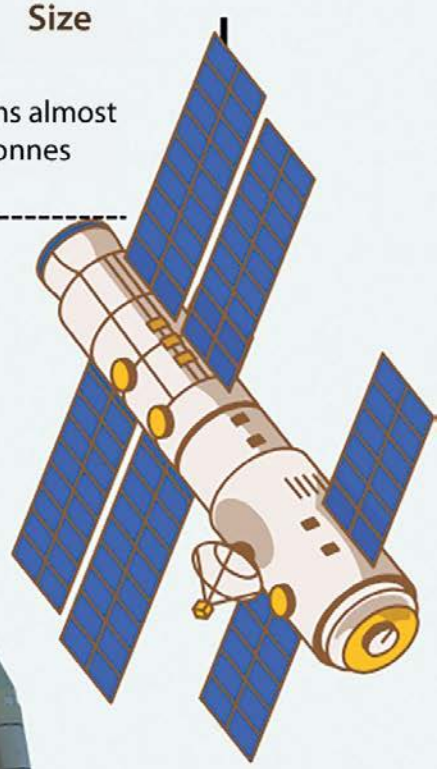
The Russian Orbital Segment (ROS), operated by Russia.

The United States Orbital Segment (USOS), run by the United States and other countries.

Significance

It serves as a microgravity and space environment research laboratory.

More than 3,000 experiments have been conducted aboard ISS.



India's mission

India plans **to have own space station by 2035** which would weigh 20 tonnes.

Would orbit an altitude of 400 km above earth, where astronauts could stay for 15-20 days.

NASA and ISRO to launch a joint mission to ISS in 2024.

Notable success

Medical discovery- Advancements in osteoporosis treatments and understanding muscle atrophy.

Dark matter- Alpha Magnetic Spectrometer (AMS), which is intended to detect dark matter.

Mission Objectives

- **Promoting Commercial Space Activities**: Showcases the potential of commercial operations in Low Earth Orbit (LEO), including **space tourism** and **private research**, while supporting future **commercial space station development**.
- **Fostering International Collaboration**: Features a **multinational crew** to emphasize **global cooperation** in space exploration through **joint research** and **diplomatic engagement**.
- **Advancing Space Research**: Conducts **scientific experiments in microgravity** in fields like **biology, materials science**, and **Earth observation.** These experiments are expected to offer insights with real-world applications in medicine, sustainability, and technology.

Key Highlights

- **Spacecraft and Crew Composition**: Features a **diverse crew** of professional astronauts, scientists, and private individuals, reflecting the **new era of commercial and inclusive spaceflight**.
- **Mission Activities**: During the **14-day ISS stay**, the crew carried out **research experiments, tech demonstrations**, and **educational outreach**, enhancing both **scientific knowledge** and **commercial potential**.

- **Path to Commercial Space Station**: Supports **Axiom Space's goal** of building the **first private space station**, ensuring a seamless transition from the ISS to independent commercial platforms in the near future.

Experiments Conducted by Shubhanshu Shukla

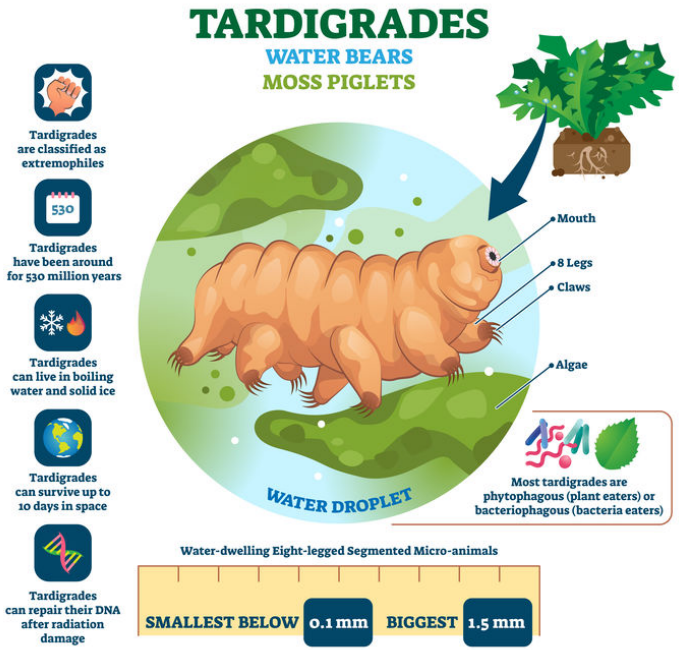
- **Seed Germination in Microgravity:**
  - Involved green gram and fenugreek seeds.
  - **Goal:** Study early plant development under microgravity.
  - Led by UAS Dharwad and IIT Dharwad scientists.
  - Seeds to be grown for multiple generations on Earth to assess:
    - Genetic changes
    - Microbial ecosystem shifts
    - Nutritional profile variations
- **Microalgae Deployment:**
  - Investigating microalgae for space-based food, oxygen, and biofuel production.
  - Ideal for long-duration missions due to their resilience.

- Microalgae are **single-celled photosynthetic organisms** that convert sunlight, water, and carbon dioxide into biomass, oxygen, and useful nutrients.

- **Crop Seed Imaging:**
  - Six crop varieties observed for multi-generational growth post-mission.
  - **Aim:** Identify traits suitable for space farming and genetic enhancement.
- **Stem Cell Research:**
  - Exploring whether supplements can accelerate healing, growth, or repair in microgravity.
  - Potential implications for regenerative medicine in space.
  - **Significance:**
    - Advances India's space life sciences research.
    - Supports development of sustainable life support systems for future space missions.
    - Opens doors for agri-biotech innovations in extraterrestrial conditions.

Significance of Axiom Mission 4 for India

- **Scientific Advancements**:
  - **c Research**: Studies DNA repair and stress tolerance in space, crucial for astronaut health.
    - **Tardigrades,**also known as "water bears" or "moss piglets", are microscopic, water-dwelling animals known for their extreme survival abilities.
    - Found in moss, lichen, soil, freshwater, and marine environments
    - Survival Superpowers: Extreme temperatures (−272°C to 150°C),High radiation levels, Vacuum of space, High pressures etc.
  - **Plant Growth Experiments**: Uses Indian crops to explore seed germination and nutrient uptake in microgravity, aiding future space farming.
- **Support for Gaganyaan Mission**:
  - Provides operational experience in **orbital docking**, **microgravity adaptation**, and **crew systems**, benefiting ISRO's 2027 human spaceflight.



- **Progress in Space Medicine**:
  - Involves research on **muscle atrophy, stem cells**, and space-linked **disease models** (e.g., diabetes, cancer), vital for long-duration missions.
- **Boost to Space Diplomacy**:
  - Enhances India's partnerships with **NASA, Axiom Space, and SpaceX**, showcasing India as a **trusted global space partner**.
- **Revival of Human Spaceflight**:
  - Marks **India's return to crewed space missions** after 41 years, building momentum and public support for future missions.
- **Exposure to Advanced Technologies**:
  - Provides hands-on experience with **AI-based navigation, autonomous docking**, and **biocapsule systems**, expanding ISRO's tech capabilities.
- **Support for Space Sector Reforms**:
  - Encourages **private sector participation**, in line with **IN-SPACe** and **Space Policy 2023**, fostering innovation in **life sciences, robotics**, and **payload integration**.

- **International Branding**:
  - Strengthens India’s reputation as a **reliable space power**, attracting global collaborations and commercial opportunities.

Way Ahead for India After Axiom Mission 4

- **Accelerate Gaganyaan Preparations**
  - **Leverage lessons** from the Axiom mission 4 in spacecraft operations, crew safety, and life support systems.
  - Conduct **uncrewed test flights and abort missions** systematically to validate systems.
- **Expand Astronaut Training**
  - Explore **international collaborations** for further exposure, especially with NASA, ESA, and JAXA.
  - Establish a **dedicated astronaut training centre in India** for long-term human spaceflight needs.
- **Boost Public Engagement and Outreach**
  - ISRO should **proactively share updates**, behind-the-scenes content, and astronaut stories to inspire public interest, especially among students.
  - Use **astronauts as STEM ambassadors** to promote science education and research in India.

- **Invest in Long-Term Capabilities**
  - Begin groundwork for **India's space station**, as hinted in ISRO's long-term vision.
  - Develop indigenous expertise in **space medicine, habitability systems**, and **life support technologies**.
  - Encourage **private sector participation** in space R&D and crewed missions.
- **Promote Space as Strategic and Soft Power**
  - Highlight India's human spaceflight capabilities in global forums like the **UN Committee on the Peaceful Uses of Outer Space** (COPUOS).
  - Use space missions to **project India's technological prowess**, fostering international goodwill and influence.

Conclusion

India's participation in Axiom Mission 4 is a **transformational step** toward realizing its human spaceflight ambitions. It bridges **technological gaps**, sharpens **astronaut training**, boosts **scientific research**, and ignites **public imagination**, all of which are crucial to the success of **Gaganyaan** and future space programs.

PRACTICE QUESTION

Q. India's participation in Axiom Mission 4 marks a strategic leap in its human spaceflight programme. Critically examine how this collaboration strengthens the Gaganyaan mission and outline the way forward for India's human space exploration. (250 words)