FINDER
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The approaching AI surge, its global consequences

Prelims: General Studies Paper - 1
Indian Polity and Governance-Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.

Mains: General Studies - 3
Challenges to internal security through communication networks, role of media and social networking sites in internal security challenges, basics of cyber security; money-laundering and its prevention.

1. Context

- **Artificial Intelligence (AI)** is emerging as a **transformative technology** comparable to the **Industrial Revolution**.
- Rapid advances in **Large Language Models (LLMs)** are accelerating global technological change.
- **Geopolitical rivalry**, particularly between the **United States and China**, is intensifying in the AI domain.
- The global system is already experiencing **economic fragmentation**, **weaponisation of supply chains**, and **strategic competition**, but **AI may become the biggest disruptor of the international order**.
- Many **world leaders and institutions are not fully prepared** for AI's long-term implications.

2. AI as a Strategic and Civilisational Force

- AI is becoming a **strategic enabler** across sectors such as **fintech, healthcare, diplomacy, intelligence, and governance**.
- It enhances:
  - **Information flows**
  - **Surveillance capabilities**
  - **Communication systems**
  - **Analytical decision-making frameworks**
- AI is increasingly seen as a **tool of government power**, and countries are trying to build their own **independent AI systems.**
- There are **concerns about the reliability of AI**, especially because it can sometimes produce **false or fabricated information ("hallucinations")**.
  - It can be risky in **legal and institutional decision-making**.
- AI's influence is expanding across **civilisational networks and global governance structures**.

3. Military Transformation and Security Risks

- AI is driving a **paradigm shift in warfare**, including:
  - Movement from **human-controlled systems to autonomous systems**
  - Growth of **unmanned aerial vehicles (UAVs)** and **autonomous weapon platforms**
  - Integration of **cyber, space, and electronic warfare**
- The **Russia-Ukraine conflict** demonstrates **asymmetric warfare enabled by AI-driven technologies**, including **low-cost drones and intelligent targeting systems**.
- AI could become the **greatest force multiplier in military history**, redistributing power away from **traditional military hierarchies**.
- Major risks include:
  - **Autonomous drone swarms**
  - **AI-driven cyber weapons**
  - **Terrorist misuse of AI technologies**
  - **Loss of human control over autonomous systems**

4. Need for Governance and Oversight

- AI development may **outpace institutions designed to regulate technology**.

- There is an urgent need for **global checks and balances** to manage **runaway AI systems**.
- AI can also contribute positively through:
  - **Crisis response**
  - **Conflict prevention**
  - **Predictive analysis**
  - **Diplomatic decision-making**
- **Scientists, policymakers, and global institutions must collaborate** to ensure AI remains **beneficial rather than destructive**.
- The central challenge is ensuring **human oversight and accountability in AI-driven systems**.

Fighter push — HAL's experience with private enterprise

Prelims: General Studies Paper - 1
Indian Polity and Governance-Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.

Mains: General Studies - 3
Various Security forces and agencies and their mandate.

1. Context

- An **air force's operational strength** depends on three factors:
  - **Advanced weapons inventory**
  - **Skilled personnel**
  - **Reliable supply chain**
- The **Indian Air Force (IAF)** operates a mix of **Russian, Western, and indigenous aircraft**.
- **HAL (Hindustan Aeronautics Limited)** is currently **India's only aircraft manufacturer**, handling **production, repair, and overhaul**.
- Due to **delays, heavy workload, and capacity constraints**, the government is considering **private sector participation** in developing the **Advanced Medium Combat Aircraft (AMCA)**.

2. Challenges in Private Sector Involvement

- **Private companies lack experience** in designing and developing **fighter aircraft**, especially **fifth-generation fighters**.
- Fighter aircraft development involves **complex design, testing, weapon integration, and long-term maintenance**.
- **Infrastructure requirements** (testing facilities, manufacturing units, equipment) are **expensive and time-consuming to build**.
- A private firm may hesitate to invest heavily when the **contract is limited to prototype development without guaranteed production orders**.

3. Institutional and Coordination Issues

- Earlier aircraft projects benefited from **close coordination between design, testing, and manufacturing agencies**.
- Currently:
  - **Aeronautical Development Agency (ADA)** handles **design**
  - **HAL** handles **production and support**
- In the **AMCA project**, with **government design agencies and private manufacturers**, **questions of ownership, coordination, and responsibility** may arise.
- **Flight-testing expertise and trained test pilots** are limited resources in India.

4. Infrastructure and Location Considerations

- India already has a strong **aerospace ecosystem in Bengaluru**, including:
  - **HAL facilities**
  - **National Flight Test Centre**
  - **IAF testing establishment**
- Suggestion:
  - **Private manufacturers should use existing infrastructure** where possible.
  - **HAL facilities could be shared** since they were built with **public funds**.
- The **AMCA production facility should be located in the hinterland**, preferably **near Bengaluru**, rather than near **border regions**.
- The **AMCA is a national strategic project**, requiring **collaboration between public and private sectors**.

Global warming and pollution are stripping vibrant colours from nature

Prelims: General Studies Paper - 1
General issues on Environmental ecology, Biodiversity and Climate Change

Mains: General Studies - 3
Conservation, environmental pollution and degradation, environmental impact assessment

1. Background

- In the last 20 years, over **half of the oceans have turned greener, while forests are browning prematurely.**
- Species are **altering colours due to rising temperatures,** habitat loss, urbanisation, and pollution.
- Colour is vital for **camouflage, thermoregulation, predator avoidance**, and reproduction.
- Hence, **colour change signals deep ecological stress,** not mere aesthetic decline.

2. Climate Change and Adaptive Colour Shifts

- **Amazon study (Biodiversity and Conservation):** Deforestation reduced the most colourful butterflies; **disturbed areas favoured duller species for camouflage**.
- **Industrial Revolution** showed a similar shift, where soot-darkened trees led to dominance of **darker peppered moths.**
- **Reduced melanin** under warming leads to lighter bodies; **eumelanin** gives dark shades, **pheomelanin** gives yellow/red hues.
- **2024 (Ecology and Evolution):** Insects in the temperate northern hemisphere are turning lighter due to frequent heatwaves, aiding thermoregulation.
- **Bogert's rule** links darker colour with colder regions in **cold-blooded animals**.
- **Gloger's rule** links darker colour with humid regions in **warm-blooded animals**.
- **2024 (Molecular Ecology):** In Europe, milder winters increased **dominance of brown morph tawny owls** due to better UV protection.
- While adaptive, such colour shifts may **reduce mating success and impose fitness costs**.

3. Urbanisation, Pollution and Ecological Signalling

- **2024 China study (547 bird species)**: Urban birds were darker and duller; rural areas retained more colourful species.
- Urban plants produce fewer **carotenoids,** weakening colour signals that attract animals.
- **2020 Study (Current Biology):** Flowers altered UV pigments to prevent sunlight damage, possibly **reducing pollinator attraction.**
- **Pollution-driven pigment changes disrupt ecological signalling,** affecting reproduction and biodiversity.

4. Marine Discolouration and Ecosystem Collapse

- **February 2025:** Coral bleaching was reported in the **Gulf of Mannar, Palk Bay, Lakshadweep, Andaman and Nicobar Islands**, and the **Gulf of Kachchh**.
- **Heat stress** causes corals to **expel symbiotic algae**, increasing starvation and disease risks.
- Bleached reefs lose structure, fish and invertebrates decline, and **algae dominate.**
- Algal blooms make **oceans greener and reduce oxygen levels**, harming marine life.
- Coral reefs, like underwater forests, **sustain biodiversity and livelihoods;** their loss destabilises ecosystems.

5. Way Forward:

- Major **knowledge gaps persist**, especially in the southern hemisphere and tropics; **wider surveys are needed.**
- **Integrated field and lab monitoring** can guide targeted action.
- **Protecting microhabitats**, regulating coastal development, improving water quality, and tracking stress indicators can reduce damage.
- **Regenerated Amazon forests** showed recovery in butterfly colours.

6. Conclusion:

- Ecological discolouration reflects systemic environmental stress. **Timely climate action, habitat restoration**, and **pollution control** can still restore ecological balance.

A reckoning for India's aviation sector

Prelims: General Studies Paper - 1
Economic and Social Development-Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, etc.

Mains: General Studies - 3
Infrastructure: Energy, Ports, Roads, Airports, Railways etc

1. Background

- 2025 witnessed major turbulence in civil aviation, including the **Ahmedabad crash,** mass **cancellations, and prolonged delays.**
- The **December IndiGo disruption exposed system-wide fragility** rather than an airline-specific failure.
- India is the **world's third-largest domestic aviation market,** operating over **840 aircraft** and carrying more than **350 million passengers annually.**
- **IndiGo** (63-65%) and the **Air India group** (27-28%) together control nearly **90% of traffic**, with IndiGo as the **sole carrier on 60.4% of routes.**
- India accounts for **4.2% of global air traffic,** with domestic demand projected to reach **715 million passengers by 2030**.

2. Challenges

1. Pilot Bottleneck and Operational Stress

- IndiGo's **pilot-aircraft ratio is 14**, against the global norm of 18-20.
- New **Flight Duty Time Limitation (FDTL)** norms, including a **60-hour weekly cap** and stricter rest rules, exposed crew shortages.
- India requires **7,000 pilots (2024-26) and 25,000-30,000 over the next decade.**
- The **Directorate General of Civil Aviation (DGCA)** issued only 5,700+ Commercial Pilot Licences (CPLs) between 2020-24; training limits and high costs restrict supply.
- **236 foreign pilot approvals in 2025** remain temporary and costly stopgaps.

2. Regulatory and Safety Gaps

- Nearly **half of the DGCA's sanctioned technical posts** remain **vacant**.
- By late 2025, **19 safety notices cited FDTL breaches** and operational lapses.
- Airlines operate with **minimal spare crew, unlike the global 20-25% buffer**, causing cascading disruptions.

3. Market Concentration and Fragility

- **Duopoly concentration** converts airline stress into **loss of connectivity.**
- **Tier-2 and Tier-3 cities** depend on limited carriers.
- **Repeated airline failures** reflect cost pressures, weak regional demand, infrastructure gaps, and **Aviation Turbine Fuel (ATF)** price volatility linked to the United States dollar.

3. Way Forward

- **New regional entrants** (Shankh Air, Al Hind Air, and FlyExpress) received **No Objection Certificates (NOCs)** in December 2025 to **enhance regional connectivity.**
- **UDAN Scheme** has operationalised 625 routes and 85 airports by 2025, including 102 new Northeast routes**, targeting 1.5 crore commuters in Phase I.**
- However, mere entry without structural reform may redistribute fragility.

Policy priorities:

- **Strengthen pilot training capacity** and regulatory staffing.
- Ensure **effective UDAN subsidy implementation** and **preferential slot allocation.**
- **Develop Tier-2 and Tier-3 airport infrastructure** in a coordinated manner.
- Consider **fuel hedging mechanisms or ATF tax relief** to offset price volatility.
- Shift from ad hoc crisis management to systemic reform.

KEYWORDS

UDAN Scheme

- UDAN (Ude Desh ka Aam Nagrik) was **launched on 21 October 2016** under the **National Civil Aviation Policy, 2016** by the Ministry of Civil Aviation
- It aims to promote **affordable regional air connectivity**.
- The first UDAN flight operated on **27 April 2017 between Shimla and Delhi.**
- It connects **unserved and underserved airports in Tier-2 and Tier-3 cities** through a market-based model supported by **Viability Gap Funding (VGF)**
- VGF provides financial support to **Public-Private Partnership projects** that are **economically desirable but not financially viable on their own**
- Airlines receive **financial incentives, excise concessions on Aviation Turbine Fuel,** and airport charge waivers;
- States **reduce Value Added Tax** on fuel and provide essential services.
- The scheme progressed through multiple phases **(UDAN 1.0 to UDAN 5.0),** covering helipads, seaplanes, tourism routes, and North-East, island, and hilly regions.
- **UDAN Scheme** has operationalised 625 routes and 85 airports by 2025, including 102 new Northeast routes**, targeting 1.5 crore commuters in Phase I.**

National Council of Educational Research and Training (NCERT)

- The **National Council of Educational Research and Training (NCERT)** is an **autonomous organisation** established by the **Government of India in 1961** to support the **qualitative development of school education** in the country.
- It functions as an **advisory body to both the Central and State Governments** on **educational policies and programmes**.
- The **key objectives of NCERT include conducting, promoting, and coordinating research in school education**.
- It also focuses on **developing and publishing model textbooks, supplementary learning materials, journals, newsletters, educational kits, and multimedia digital content**.