CURRENT EVENTS AND ANALYSIS

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NATIONAL POLITY

&

SCIENCE AND TECHNOLOGY

Editor

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NATIONAL POLITY

100 years of Public Accounts Committee (PAC)

In the Central Hall of Parliament, on December 4, 2021, the President Ram Nath Kovind inaugurated the two-day centennial celebrations of the Committee on Public Accounts in the presence of Vice-President M. Venkaiah Naidu, Lok Sabha Speaker Om Birla, and PAC's Chairperson, Adhir Ranjan Chowdhury along with Union Ministers, MPs and presiding officers of the State legislative bodies.

At the function, **Ram Nath Kovind** said, "Parliament embodies the people's will and its committees work as its extension. It is a welcome division of labour - the committees allow the Parliament to debate all issues while select groups of the MPs devote more focus on select matters".

Mr. Naidu called for **harmonising the welfare expenditure on freebies with developmental needs** and urged the PAC of the Parliament to examine this aspect to enable wider public discussion. He said, "we are all alive to the present scenario of various Governments indulging in doling out freebies for obvious reasons… it is time for a wider debate on harmonising the objectives of welfare and development… so that both the short-term and long-term objectives get equal attention".

He also urged the PAC to reinvent itself based on its experience of the last 100 years to more effectively ensure financial discipline, saying, "the Union Budget expenditure has increased from a mere Rs.197 crore in the first Budget to Rs. 35 lakh crore now, making its PAC's scrutiny much more complex and challenging".

Om Birla said parliamentary committees should make the executive accountable for the country's development. He also called for creating **a common digital platform for the PACs of Parliament and State Legislatures** for sharing their (PACs') best practices and monitoring implementation of their recommendations. He also suggested that **parliamentary committees should directly interact with people** and take inputs from them to make more effective recommendations.

About the Public Accounts Committee (PAC):

Set up in 1921 based on the GoI Act, 1919, the Committee on Public Accounts is the oldest and mother of all parliamentary committees. After Independence, it underwent a change in terms of its constitution and functions.

The PAC has always been a committee of Lok Sabha following the rules of Lok Sabha and taking its assistance. Though the PAC of the UK does not include members of the House of Lords, the PAC in India began to include members of Rajya Sabha since 1954 because the reports of the CAG are, under the Constitution, to be laid before the legislature. Now, the **PAC has 22 members (with 15 from the Lok Sabha and 7 from the Rajya Sabha)** who are elected by the MPs every year for one year term. Under the Lok Sabha's rules, a minister can not become a member of the PAC. The PAC's Chairman is appointed by the Speaker from among, since 1967, the members of the Opposition in the PAC.

Thus, the PAC's composition is such that it represents all shades of opinion in Parliament. However, on the ground that one year tenure of the PAC is too short to get the feel of its work, it has been suggested that the term of the PAC should be coextensive with the term of Lok Sabha and that 1/3 of PAC's members should retire annually. Though this suggestion has not been accepted, most of the PAC's members are re-elected for a second term to ensure continuity in its composition and approach.

The **main function** of the PAC is to examine the report of the CAG on the audited accounts of the GoI, and examine any other report laid before the Lok Sabha. The report of the CAG is divided into 2 parts: Finance Accounts set out receipts, disbursements and cash balances whereas Appropriation Accounts compare the grants made by the legislature for different purposes with the actual expenditure on these purposes. **While examining the CAG's reports, the PAC has to check whether public money has been spent in keeping with the legislative intent (of granting the money) and it calls attention to cases of waste in expenditure.** Though the PAC's functions are co-extensive with those of the CAG, the members of PAC can, more than the CAG, understand the legislative intent and can better express their judgement in the PAC's report to Lok Sabha.

Every year, as soon as the CAG's bulky audit report reaches the PAC, the PAC selects a few important items for detailed examination for the year, prepares a 'Key of the Audit Report' and sends it to the concerned ministries and departments. As the accounts of each department come up for discussion, they send their representatives to appear before the PAC as witnesses to explain their position. The CAG also attends the meetings of PAC which are held in private. **With the help of CAG, the PAC prepares a report on its views on the accounts of different departments and submits the report to the Lok Sabha.** Unlike the Departmentally Related Standing Committees (DRSCs) which adopt reports with dissent notes by some members, the PAC must adopt all reports by consensus, and this helps maintain its political neutrality.

Evaluation:

Though the PAC may suo moto examine one or more subjects over and above those contained in the CAG reports, the scope of PAC's work is largely co-extensive with the CAG's audit reports. In this sense, the CAG is both a strength and weakness of the PAC.

Policy matters are not to concern the PAC and the PAC can not disallow any item of expenditure, but most of its recommendations are accepted by the Government. Though the PAC's work is in the nature of post-mortem, its **reports have gone a long way in disciplining the financial system** besides drawing attention to the shortcomings in the working of govt departments.

Lack of consensus in finalising reports has frequently seen controversy over the role of its Chairman. For example, in July 2020, the PAC failed to reach a consensus on examining the government's response to the Covid-19 pandemic, or the PM-CARES fund set up to deal with the crisis. To maintain neutrality, PAC would do well to focus more on the administration of policy rather than the policy itself.

Supreme Court: Issue Aadhaar, Voter Cards to Sex Workers

Stating that the fundamental rights including the right to food under Article 21 are guaranteed to every citizen of the country irrespective of his/her vocation and the State has the duty to provide basic amenities to its citizens, the Supreme Court, on January 11, 2021, directed the States and UTs to immediately start the process of issuing voter ID cards, Aadhaar and ration cards to sex workers across the country.

The court said, "the status report on issuance of these cards to them be filed within four weeks from today and in the meanwhile, States and UTs should continue distribution of dry ration to sex workers without insisting on their identity proofs as mentioned in earlier orders". The Supreme Court's latest directions are in line with its previous directions:

i. **2011:** to the States and UTs to issue ration cards and identity cards to sex workers.

ii. **September 29, 2020:** to all the States to provide dry rations to sex workers, who are identified by National AIDS Control Organization (NACO) and legal services authorities, without insisting on any proof of identity.

In the latest case, the apex court was hearing a plea filed by NGO 'Durbar Mahila Samanwaya Committee', which has highlighted the destitution of sex workers in the wake of COVID-19, and sought relief measures for over 9 lakh female and transgender sex workers across India.

According to the court's amicus curiae (Jayant Bhushan) in this case, dry ration, which was distributed for a few months, was stopped after a while. With some improvement in the situation caused by the pandemic, the court has passed these directions.

CJI N.V. Ramana's Speech on Freedom of the Press

Delivering a keynote address at the Red Ink Awards for excellence in journalism, presented by the Mumbai Press Club on December 29, 2021, the CJI N.V. Ramana said, "mixing news with views is a dangerous cocktail and, nothing can be more lethal to democracy than the deadly combination of confrontational polity and competitive journalism."

He said, "**Journalists are like judges in one sense.** Regardless of the ideology you profess, you must do your duty without being influenced by it. You must report only the facts, with a view to give a complete and accurate picture."

Highlighted the importance of press freedom, he said, "Unlike print and electronic media, unfortunately, **it is almost impossible to hold social media platforms such as YouTube accountable** even after they host most derogatory and defamatory stuff which has the potential to ruin careers and lives."

International Arbitration and Mediation Centre (IAMC), Hyderabad

On December 18, 2021, India's first **International Arbitration and Mediation Centre (IAMC)** was inaugurated in Hyderabad by CJI N.V.Ramana and Telangana CM Chandrasekhar Rao. The IAMC, a brainchild of the CJI, has been set up by a trust at a temporary accommodation in Gachibowli and would finally be moved to an own building of the Trust for which land was allotted by the Telangana Government in Puppalaguda, nearly 12 km from Gachibowli.

Need for an International Arbitration and Mediation Centre in India:

Arbitration and mediation are mechanisms of Alternative Dispute Resolution. Their advantages - low cost, speed, more control over timelines and process, autonomy of parties, more comfortable environment and non-adversarial nature - are more important in international commercial disputes as there is often mistrust towards national courts, and insecurity on which law to apply.

However, in 2019, though India ranked 63rd in the World Bank's ease of doing business rankings, it remained at 163rd place (among 190 countries) in enforcement of contracts due to delays in India's judicial system. While inaugurating the IAMC in Hyderabad, the CJI quoted P.V. Narsimha Rao as saying, "any democracy worth the name must provide for effective means of dispute resolution at a reasonable cost; otherwise, the rule of law becomes a platitude and people may take the law into their own hands disrupting peace, order and good government".

International arbitration centres are located in commercial city hubs like there at London, Paris, Singapore, New York and Stockholm. Arbitration centres have already been set up in India, most prominently in Delhi and Mumbai. Still, domestic and international parties prefer to go abroad for dispute resolution.

The IAMC has been set up in Hyderabad to change that trend and speed up the process. The CJI said, "the IAMC would have the best infrastructure and world acclaimed international arbitrators would be its panellists. By adopting best practices in the arbitration of commercial disputes, it would become an institution on a par with that of London and Singapore".

What are alternative dispute resolution mechanisms?

Alternative Dispute Resolution ("ADR") refers to any means of settling disputes outside of the courtroom. Unlike adversarial litigation in courts, ADR is often collaborative and allows the parties to come up with more creative solutions that a court may not be legally allowed to impose. While **negotiation** is almost always attempted first to resolve a dispute, mediation and arbitration are the two most common forms of ADR and recently gained prominence due to delayed justice and rising costs of litigation in courts.

In **mediation,** an impartial third party (mediator) merely facilitates dialogue between the parties so they can communicate better and settle the dispute themselves. In **conciliation,** the third party plays a more proactive and advisory role than that of a mediator, for example, by making a proposal to the parties. In **arbitration,** the third party (arbitrator) hears arguments and evidence from each side and then decides on the dispute himself/herself.

Arbitration is more formal than mediation and conciliation, but is less formal than a court trial, involving simplified rules of evidence (ex. hearsay is usually admissible in arbitration). Unlike other methods of ADR, once the parties have submitted a matter to arbitration, neither can withdraw from the procedure. The arbitrator's decision (or 'award') is binding on the parties (subject to their right to challenge it). While entering into a contract, the parties usually insert an arbitration clause in it, laying out the terms of arbitration (number of arbitrators, arbitration forum; fees etc.) to resolve the disputes that might arise from the contract in future.

Legal Framework in India:

The **Arbitration and Conciliation Act, 1996 read with the Indian Contract Act, 1872** provide the legal framework governing arbitration, conciliation and mediation in India.

The 1996 Act has provisions on domestic arbitration and international commercial arbitration and enforce foreign arbitral awards. It was also amended in 2015 and 2019 to reduce court involvement in arbitration.

Section 89 of the Civil Procedure Code, 1908 gives the courts an option to refer sub judice matters to arbitration, conciliation or mediation. In such cases, the provisions of the 1996 Act shall apply.

Prohibition of Child Marriage (Amendment) Bill, 2021

On December 15, 2021, the Union Cabinet cleared **a proposal to raise the minimum age of marriage of women from 18 to 21 years,** and bring uniformity in the marriageable age of men and women. To this effect, on December 20, 2021, the **Prohibition of Child Marriage (Amendment) Bill, 2021** was introduced in the Lok Sabha which has referred this Bill to the Standing Committee after MPs demanded a deeper scrutiny and wider consultations.

Background:

Raising the age of marriage is one of the recommendations made in December 2020 by a task force headed by **Jaya Jaitly.** The task force was appointed in June 2020 to examine the correlation of marriage age and motherhood with the health and nutritional status of the mothers and infants as reflected in MMR, IMR, etc. It was also tasked to suggest measures for promoting higher education among women.

Prohibition of Child Marriage Act (PCMA), 2006

It was enacted replacing the Sharada Act, 1929. Under the Act, a child is a person who, if a male, is under the age of **21 years** and if a female, is under the age of **18 years.** A child marriage is a marriage to which either of the contracting parties is a child.

The Act **makes a child marriage voidable** at the option of a contracting party being a child. In other words, a child marriage can be annulled if a case is filled in a district court by a contracting party (who was a child) within two years of attaining majority (18 years). In 2017, Karnataka amended the PCMA to invalidate child marriage from the very outset.

The PCMA **applies to all citizens** within India and outside, and prescribes a **jail term of up to 2 years** for the male adult of above 18 years or anyone who abets a child marriage.

What is changed by the Prohibition of Child Marriage (Amendment) Bill, 2021?

By amending the Prohibition of Child Marriage Act (PCMA), 2006, the Bill seeks to change **the definition of a child** to a male or female who has not completed the age of 21 years. The Bill

also amends certain other personal laws to raise the minimum age of marriage of females under those laws to 21 years. These are:

i. Indian Christian Marriage Act, 1872,

ii. Parsi Marriage and Divorce Act, 1936,

iii. Hindu Marriage Act, 1955,

iv. Special Marriage Act, 1954, and

v. Foreign Marriage Act, 1969.

The bill seeks to reduce the **time period for filing petition to annul a child marriage.** Now, a child marriage can be annulled if a case is filled in a district court by a contracting party (who was a child) within 5 years of attaining majority (18 years), that is, when he/she completes 23 years.

The bill adds that the Act shall have an **overriding effect on any other law or custom** governing the parties to the marriage.

Critical Evaluation:

The Bill is **aimed at** gender neutrality in the age of marriage, reducing the risks of early pregnancy such as high MMR, high IMR, stunted children, and improving educational opportunities to women. But, the new **legal age of marriage** proposed in the Bill contradicts other laws where the **legal age of competence** is recognised as 18 years.

- The **61st Constitutional Amendment Act, 1988** defines the voting age as 18 years.
- The **Majority Act, 1875,** defines 18 years as the gender-neutral age of majority. Under the Indian Contract Act, 1872, a person should have attained the age of majority in order to enter into a contract.
- **Protection of Children from Sexual Offences (POCSO) Act, 2012** implies that the age of consent for sex is also 18 years.
- The **Juvenile Justice (Care and Protection) Act, 2015,** which deals with juvenile offenders and children in need of care and protection, also defines a child as one under 18 years.
- The **Right of Children to Free and Compulsory Education, 2009** defines a child as one between 6 and 14 years.
- The **Child Labour (Prohibition and Regulation) Amendment Act, 2016,** which bans the engagement of children (below 14 years) in all occupations and of adolescents (between 14 and 18) in hazardous occupations.

Thus, the minimum age to vote and to enter into contracts is 18 years. Now, the new Bill assumes that a woman who is above 18 years has the mental capacity to make decisions that will affect her life commercially or as a citizen, but she does not have the right to make decisions that affect her personal life. How far is it logical? In fact, the **Law Commission's 2018 report on Reform of Family Law** proposed that the age of majority should also be recognised as the minimum age of marriage for men and women.

The answer to checking child marriages lies in improving access to education since the practice is a social and economic issue. According to the National Family Health Survey-5, **in 2019-2021, 23.3% of women in the age of 20 to 24 were married before the age of 18,** which shows that the Prohibition of Child Marriage Act, 2006, has not succeeded fully in preventing child marriages, especially among the poor. Parents often use this Act to punish their daughters who marry against their wishes or elope to evade forced marriages and domestic abuses. It is more likely that the change in the age limit will increase parents' authority over young adults.

Karnataka Assembly Passes a Bill Against Religious Conversion

Karnataka Assembly on December 23, 2021 adopted the **Karnataka Protection of Right to Freedom of Religion Bill, 2021** through a voice vote, even as the Congress and Janata Dal (Secular) members staged a dharna in the well of the assembly.

The Bill prohibits conversion by "misrepresentation, force, allurement, fraudulent means, or marriage". Under the bill, voluntary conversions must follow a procedure involving the district magistrate.

The bill makes forced or induced conversion a cognisable and non-bailable offence that will attract a jail term of 3-5 years and a fine of Rs. 25,000. It also proposes a jail term of 3-10 years, and a fine of Rs. 50,000 for people forcibly converting persons from SC/ST communities, minors and women to another religion.

Constitutional validity of anti-religious conversion laws:

The **Orissa Freedom of Religion Act, 1967** and the **Madhya Pradesh Dharma Swatantrya Adhiniyam, 1968** made it a penal offence to convert or attempt to convert a person by force, fraud or inducement' or allurement. Both these laws were challenged by Christian missionaries in the Supreme Court on the ground that the right to propagate includes a fundamental right to covert people of other faiths into Christianity by any means. This was rejected by the SC while laying down the following law in **Stanislaus v State of MP (1977):**

"The freedom to propagate, under Art. 25 (1), does not include the right to convert another because the same article grants every person the freedom of conscience - the right to choose and hold any faith of his/her choice. According to Art. 25(1), the freedom of conscience is subject to public order, morality or health. Hence, **conversion by force, fraud, inducement or allurement can be penalized by the State** as such conversion disturbs public order, morality or health."

Status of 'Freedom of Religion Laws':

Anti-conversion bills were introduced in Parliament in 1954, 1960 and 1979 but not enacted for lack of majority support. Currently **there is no national law against forced conversion** as law and order is a State subject.

After the 1977 judgement, several other states enacted anti-religious conversion laws: Arunachal Pradesh, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh and Uttarakhand.

Some of the laws provide for stiffer penalties if women, children, or members of SC/STs are converted. Further, the laws of Arunachal Pradesh, Rajasthan and Uttarakhand exclude re-conversion from punishment.

The laws of Uttarakhand (2018), Himachal Pradesh (2019), Uttar Pradesh (2020), Madhya Pradesh (2021) and recently, Karnataka (2021) ban **conversion through marriage** as well. The recent Madhya Pradesh Freedom of Religion Act 2021 was enacted to replace the state's 1968 Act on the ground that the definitions in its 1968 Act are not effective to stop forced conversions. The new Act sought to plug the loopholes in the 1968 Act and sanctioned more stringent punishments and penalties.

In the 1980s, the focus of anti-conversion laws was Muslims seeking to convert non-Muslims, while Christianity has received more attention since the 1990s. These laws were treated by the Christians as a campaign against their religion in particular, though the laws would in fact operate against any religion which resorted to conversion by force, fraud, allurement or inducement.

Election Laws (Amendment) Act, 2021

On December 21, 2021, Parliament passed the **Election Laws (Amendment) Bill, 2021** that seeks to link electoral rolls to the Aadhaar database for checking multiple enrolment of the same person in electoral rolls at different places.

What exactly does the Bill seek to amend?

It seeks to amend the **Representation of the People Act, 1950** and the **Representation of the People Act, 1951.** While the 1950 Act provides for allocation of seats and delimitation of constituencies for elections, qualifications of voters, and preparation of electoral rolls, the 1951 Act regulates the conduct of elections, and deals with offences and disputes related to elections.

The bill amends the 1950 Act to the effect that those who have applied for inclusion of their names in the electoral rolls as well as those who are already enrolled in the rolls **may be required by the voter registration officer to submit their Aadhaar numbers** for establishing their identity. Persons will not be denied inclusion in the electoral roll or have their names deleted from the roll, if they are unable to furnish Aadhaar number **due to sufficient cause as prescribed.** Such persons may be permitted to furnish alternative documents prescribed by the central government.

Who are service voters?

Service voters are those having service qualification, i.e. members of Armed Forces, members of State Police forces serving outside that state and persons employed under the GoI on posts outside India.

Even though such persons may actually be residing at a different place (of posting), they are, under the 1950 Act, deemed to be ordinarily resident in their native constituency, and they can register in electoral rolls as service voters there. The wives of such persons are also deemed to be ordinarily residing in the same constituency if they reside with their husbands.

Under the 1951 Act, **unlike an ordinary voter, a service voter along with his wifes can vote either in person or by postal ballot or by proxy duly appointed to them.** With the replacement of the word 'wife' with 'spouse', a woman Army officer's husband can also enrol as a service voter.

Currently, January 1 of every year is the **qualifying date for the enrolment** of 18-year-olds as voters under the 1950 Act. That is, every year, anyone turning 18 on or before January 1 is eligible to be a voter. In addition to January 1, the Bill designates April 1, July 1 and October 1 as qualifying dates.

The Bill amends Section 20 of the 1950 Act and Section 60 of the 1951 Act **to make the laws gender-neutral for service voters** by replacing the word 'wife' with 'spouse'. Currently, While, an Army man's wife is entitled to be enrolled as a service voter, but a woman Army officer's husband is not.

The bill also allows for the **requisition of a state government's premises** for the storage of election material, and for accommodation for security forces and election personnel. Currently, the requisition of premises is allowed only for being used as polling stations or for storing ballot boxes.

Critical evaluation:

Of all these provisions, the Bill's provision to link the electoral rolls with the Aadhaar ecosystem has attracted most criticism. Though the provision is voluntary in nature, it requires the person to show **sufficient cause** for his/her inability to furnish Aadhaar number. This means, the government will frame a separate rule defining what constitutes 'a sufficient cause'. The main grounds of criticism against this provision include:

i. It **violates individual privacy** and goes against the 2018 Supreme Court judgment that limits the use of Aadhaar to the financial and welfare benefits given by the government. The judgement barred the expansion of Aadhaar to other areas of life;

ii. It may lead to large-scale inadvertent or **targeted deletion of names,** and may help parties to profile voters as favourable or unfavourable. Some activists claim that lakhs of voters were deleted from the list of voters in Telangana in 2018, after the Aadhaar data had been used by the ECI to curate electoral rolls in Telangana and AP.

However, the Government argues that the bill passes all the three tests laid down by the Supreme Court in **KS Puttaswamy V. UoI (2017),** stating that the returning officer can only use Aadhaar as an identity document and electoral database will be with the ECI and not in public domain. While declaring the right to privacy as a fundamental right under Article 21, the Supreme Court, in 2017, laid down that if a restriction on the right to privacy is to be considered as reasonable under Article 21, it must pass three following tests:

i. There must be a law to justify such restriction on privacy;

ii. There must be a legitimate State aim to impose such restriction, which ensures that the law is reasonable and not arbitrary; and

iii. The means that is adopted to impose the restriction must be proportional to the legitimate aim of the state or the purpose of the law.

Way forward:

While an error-free Electoral Roll is sine qua non of free and fair election, the passage of the Bill may be problematic in the absence of a robust Data Protection Act. The Bill should have specified the extent of data sharing between the two databases, the methods through which consent will be obtained, and whether consent to link the databases can be revoked.

Dam Safety Act, 2021

On December 2, 2021, the Rajya Sabha passed the Dam Safety Bill, 2019, which provides **for the surveillance, inspection, operation and maintenance of all specified dams across the country to prevent dam failure related disaster.** The Bill has been debated for decades and was passed by the Lok Sabha in August 2019 and has received President's assent on december 13, 2021.

Why is a law on dam safety required?

According to the National Register of Large Dams prepared in June 2019 by the Central Dam Safety Organisation (CDSO) in the Central Water Commission (CWC), **there are currently 5,745 large dams in India,** of which 293 are over 100 years old and 1,041 dams are between 50 and 100 years old. Since 1979 when the Machhu dam in Gujarat collapsed killing thousands, there were **42 instances of dam failure,** the latest being Annamayya reservoir in AP's Kadapa district that led to the death of at least 20 people in November 2021.

After China and USA, India might rank third globally in having large dams but it has not had dam safety law till now. Since 1979, several states and PSUs that own dams set up their own dam safety organisations. But the agencies have no powers to enforce their protocols and in the absence of a central law, the safety regulations also vary from state to state.

Though the decision to make a dam safety law was taken way back in 1987, a bill to this effect was introduced in the Lok Sabha for the first time only in 2010 but was withdrawn following several changes recommended by the standing committee. It was again introduced afresh in 2019.

What does the dam safety bill seek to achieve?

The Dam Safety Bill 2019 seeks to set up institutional mechanisms for the surveillance, inspection, operation and maintenance of all specified dams across the country.

To ensure dam safety, the bill provides four layers of monitoring - two at the central level and two at the state level. A **National Committee on Dam Safety (NCDS)** headed by CWC chairman including representatives of central and state governments will evolve dam safety policies and recommend necessary regulations. A **National Dam Safety Authority** shall also be set up to implement the NCDS's policies and guidelines, and any decision taken by the NDSA shall be binding upon all the parties.

Each state government shall establish a **State Committee on Dam Safety (SCDS)** and a **State Dam Safety Organisation (SDSO).** With technical assistance from the NDSA, these bodies will be responsible for the surveillance, inspection, and monitoring the operation and maintenance of dams within their jurisdiction.

The bill also has penal provisions for violations. If anyone is found obstructing any officer authorised by the above bodies in the discharge of his/her function under the Act, or refuses to comply with any direction given by them, they shall face **a maximum of two years jail, or a fine, or both.**

The bill applies to all specified dams built on both inter and intra state rivers and whose height is above certain limit (say, 15 metres).

Critical evaluation:

In the last 10 years, several States, including Karnataka, Kerala, Tamil Nadu and Odisha, opposed the legislation on the ground that **it encroached upon the sovereignty of States to manage their dams.** Tamil Nadu fears that it will lose its hold over four of its dams, which are located in Kerala. The dams include Mullaperiyar, whose structural stability and safety has been an issue for over 40 years.

Though water is under Entry 17 of the State list, the Union Government has brought the law under **Entry 56 of the Union List.** Entry 56 allows Parliament to make laws on the regulation of inter-state rivers and river valleys if it declares such regulation to be expedient in public interest. Still it is unclear how Parliament can legislate a law for dams even where the river and its valley are entirely within a State. The Government argues that inter-State basins cover 92% of the country's area and most of the dams, making the Centre competent to enact such a law.

There is also a conflict of interest in the bill: the provision to have a representative of the CWC as a member of the NCDS (a regulatory body) would mean that CWC will function as both an advisor and regulator, which is not allowed by the Constitution according to the Supreme Court.

The bill also **focuses too much on structural safety** but disasters occur more due to the lapses in operational safety as in the case of 2018 floods in Kerala, where none of the state's dams was used for flood control and water was released from almost all dams only after Full Reservoir Level or Maximum Water Level had been reached.

Keeping up the spirit of cooperative spirit, the Union can hold talks with the States to allay their fears and frame rules suitably for the legislation.

An Army Encounter in Nagaland goes wrong, killing 13 Civilians and a Soldier

On December 4, 2021, the Army opened fire at a van carrying coal miners from the Tiru area to their village Oting about 15 km away, killing six on board mistaking them to be extremists. 7 more civilians and a soldier died when villagers, alarmed by the death of their brethren, clashed with the troops about an hour later. The next day, protests erupted across Nagaland and a mob of about 500 men vandalised a camp of Assam Rifles, a paramilitary force, in the Mon district headquarters killing at least two persons.

Soon, **Section 144 of the CrPC** was imposed in the Mon district to prevent gatherings and restrict the movement of vehicles except those carrying essential items. The State government also suspended mobile Internet and bulk SMS in the district. The State and the Army ordered separate inquiries into the incident.

What went wrong?

The Army virtually admitted to an **intelligence failure** expressing regret. Nagaland's Mon district borders Myanmar from where members of the **Khaplang-Yung Aung** faction of **National Socialist Council of Nagaland (NSCN)** carry out hit-and-run operations. With specific input of the movement of NSCN (Khaplang-Yung Aung) cadres in a vehicle of specific colour and type, the Army cordoned off the Tiru-Oting area. The coal miners approached in a similar vehicle and "did not cooperate" when asked to stop. Then the Army opened fire at it.

What are the reactions?

The **Isaak-Muivah** faction of the **National Socialist Council of Nagaland (NSCN-IM) i**s the largest Naga group that signed a framework agreement with the Union in 2015 to resolve the Naga political issue. Condemning the killings, the NSCN-IM said, "Indian security forces are trigger-happy acting with impunity under the GoI's AFSPA, 1958 which is mainly used against the Naga political movement".

After the firing, Nagaland's CM Neiphiu Rio and Meghalaya's CM Conrad Sangma have called for repeal of the **Armed Forces Special Powers Act (AFSPA), 1958.** Nagaland's assembly also adopted resolutions demanding the repeal of AFSPA and calling for strengthening the ongoing efforts to find a peaceful solution to the **"Naga political issue".**

On December 26, 2021, the Union Home Ministry reached out to all Naga insurgent groups and set up a committee to study the withdrawal of AFSPA from Nagaland and submit its report in 45

days. However, the Ministry, on December 30, 2021, extended the AFSPA in the whole of Nagaland for 6 months because the validity of the AFSPA in the state was about to expire on December 30, 2021.

What is AFSPA, 1958?

The Armed Forces (Special Powers) Act or the AFSPA, 1958 was first enacted to deal with the uprising in the Naga Hills, followed by the insurgency in Assam. It provides **special powers for the armed forces deployed in 'disturbed areas' to kill anyone acting in violation of law,** arrest and search any premises without a warrant. The security personnel involved can not be prosecuted without the Central Government's prior sanction.

According to Section 3 of AFSPA, a disturbed area is an area that is in such disturbed or dangerous condition that the use of armed forces in aid of the civil power is necessary. **Both the Centre (MHA) and the State Governments have the concurrent powers to declare an area as "disturbed".** Currently, the MHA issues periodic "disturbed area" notification to extend AFSPA only for **Nagaland** and **Arunachal Pradesh.** The notification for **Manipur** and **Assam** is issued by the State governments. Tripura revoked the Act in 2015 and it was revoked in Meghalaya by the MHA in 2018. J&K has a separate J&K Armed Forces (Special Powers) Act, 1990.

Human rights activists have said the **Act has often been used to settle private scores,** such as property disputes, with false tip-offs provided by local informants to security forces. Many politicians have built their careers on an anti-AFSPA stance, including incumbent Manipur CM N Biren Singh, who contested his first election in 2002 in order to "fight AFSPA" after 10 civilians had been gunned down by the Assam Rifles in 2000. But Assam and Manipur (with Biren being its CM) have resisted the MHA's attempt to remove areas under the AFSPA, pointing out political instability in Myanmar.

What is the Naga political issue?

The term 'Nagas' refers to a group of about 20 tribes spread across the border between India and Myanmar. Those who died the latest firing incident belong to **Konyak** tribe, the largest of the Naga tribes and dominant in Mon district. The **demand of Naga insurgent groups is** to unify all Naga-inhabited areas into a single administrative unit, called **Greater Nagalim** with a separate flag and Constitution, covering **Nagaland** and several contiguous districts of **Assam, Arunachal Pradesh, Manipur,** and a large tract of **Myanmar.**

While the Governments of Assam, Manipur and Arunachal Pradesh are strongly opposed to this, the Greater Nagalim demand has been endorsed by the Nagaland's Assembly as many as five times: in 1964, 1970, 1994, 2003 and on July 27, 2015.

How did the issue originate?

The British annexed Assam in 1826, and in 1881, the Naga Hills too became part of British India. The **Naga Club,** formed in 1918, provided the socio-political foundation for the Naga nationalist movement. In 1929, the Club told the Simon Commission "to leave us alone to determine for ourselves as in ancient times".

In 1946, the **Naga National Council (NNC)** was formed to safeguard the Naga interests in free India. Under the leadership of **Angami Zapu Phizo,** the NNC became secessionist and resolved to establish a "sovereign Naga state". In 1951, it claims to have conducted a plebiscite in which 99.9% of the Naga favoured a sovereign Nagaland. After boycotting India's first general elections, the NNC formed an underground Naga Federal Government (NFG) with a military wing, leading the GoI to enact the **Armed Forces (Special Powers) Act, 1958** to crush the insurgency. But the Indian Army's action in the Naga Hills only increased the anger among people towards the Indian State. In 1956, Phizo escaped to East Pakistan.

In 1963, the Naga Hills-Tuensang area was carved out of Assam and made into the **state of Nagaland.** On November 11, 1975, the GoI got a section of the NNC leaders to sign the **Shillong Accord,** under which this section of the NNC and NFG agreed to give up arms and accept the Constitution of India.

However, a group led by Thuingaleng Muivah who were in China then did not accept the Shillong Accord and formed the **National Socialist Council of Nagaland (NSCN)** in 1980 to carry an armed struggle against the Indian state and establish a "People's Republic of Nagaland", inspired by Mao.

However, differences emerged between them over initiating a dialogue with the Indian government. In 1988, the NSCN split into **NSCN(K)** led by Khaplang and NSCN(IM) led by Isak Swu and Muivah. While the NNC began to fade away and Phizo died in London in 1991, the NSCN (IM) emerged as the "mother of all insurgencies" in the region.

In 1997, the GoI signed **a ceasefire agreement with NSCN (IM),** setting the stage for further talks. In December 2000, NSCN (K) also announced a unilateral ceasefire, expressing its willingness for talks. In 2003, the then PM Vajpayee visited the state and acknowledged the "unique history of the Nagas" and admitted India's mistakes. Neither Indira Gandhi nor Rajiv Gandhi visited Kohima as Prime Minister.

What is the current status?

After coming to power in 2014, in its reach out to the Northeast, the BJP sought to fast-track the resolution of Naga political issue. Nagaland governor Ravi and NSCN-IM's general secretary Thuingaleng Muivah signed **a Framework Agreement, 2015** in the presence of PM Modi **to find a solution to the Naga political issue.** The Union subsequently attempted to make the peace process inclusive by involving other Naga insurgent groups under the umbrella of **Naga National Political Groups (NNPGs)** in 2017. But involving other insurgent groups in suspicion about Delhi exploiting divisions within the Nagas on tribal and geopolitical lines. On the other hand, another important group, the NSCN (K), whose cadres are inside Myanmar, is still outside this formal process.

In June 2020, Ravi who is also the Centre's interlocutor in the Naga peace talks, expressed his anguish over extortion and collapse of law and order in Nagaland, where organised armed gangs run their own parallel 'tax collection' regimes. A major aim of the NSCN-IM has been to acquire formal recognition to this informal practice through negotiations. For the reasons described above, the NSCN (IM) demanded the removal of Ravi from the peace talks.

In September 2021, RN Ravi was removed as Nagaland's Governor moved to Tamil Nadu. The MHA then appointed retired IB Special Director **A.K. Mishra** to continue talks with the NSCN-IM. The official said it was too early to say if the latest Mon incident will have a bearing on the ongoing talks.

Conclusion:

Overall, the Centre must keep in mind that most of the armed insurgencies across the world do not end in either total victory or comprehensive defeat, but in a grey zone called 'compromise'. It has become even more urgent in view of China's unusually aggressive behaviour in Ladakh.

J&K Delimitation Commission's proposal to increase 6 seats for the Jammu division and one for the Kashmir division

On December 20, 2021, the J&K Delimitation Commission, headed by Justice **Ranjana Prakash Desai,** proposed to increase 6 seats for the Jammu division and only one for the Kashmir division, besides suggesting, for the first time, reservation of 9 seats for STs and 7 for SCs. The draft proposal has attracted sharp reactions from the regional parties.

If these proposals are implemented, the assembly constituencies in the Jammu division stand at 43 against 47 in the Kashmir division. The Commission has not specified the districts where the SC and ST seats have been reserved.

Why delimitation in J&K now?

Though delimitation of J&K's Lok Sabha constituencies is governed by the Indian Constitution, delimitation of its Assembly seats (until its special status was revoked on 5 August 2019) was governed by the J&K Constitution and J&K Representation of the People Act, 1957. On the basis of the Census 1981, apart from **24 seats vacant and reserved for Pak-occupied Kashmir, J&K had 87 assembly constituencies** (46 in Kashmir, 37 in Jammu and 4 in Ladakh). While the State as a whole had 111 seats, it would hold elections for 87 seats.

However, on 5 August 2021, apart from revoking Article 370 of the Indian Constitution and thus ending J&K's special status, the Parliament passed the **J&K Reorganisation Act, 2019** turning the State into two Union Territories - one (J&K) with legislative assembly and the other (Ladakh) without legislative assembly. With 4 assembly seats in Ladakh declared void, the effective strength of the assembly of J&K union territory has fallen to 83 from 87. This should now be raised to **90** under the J&K Reorganisation Act. On the whole, the J&K union territory would now have **114** assembly constituencies including the **24** seats vacant and reserved for PoK.

In March 2020, under the J&K Reorganization Act, 2019 and Delimitation Act, 2002, the GoI set up a **J&K Delimitation Commission to delineate 7 more constituencies in J&K union territory, based on the Census 2011.** Headed by a former SC Judge Ranjan Prakash Desai, the Commission comprises all the five MPs from the UT of J&K, two from the BJP and three from the National Conference.

Why criticism against the proposals of the J&K Delimitation Commission?

According to the regional parties, out of 7 new assembly constituencies to be created in the J&K Union Territory, only one constituency has been created in the Kashmir division but 6 in the Jammu region. This is not justified by the Census 2011, according to which the Jammu division has 53.5 lakh population and the Kashmir division 68.8 lakh.

According to them, the recommendations of the J&K Delimitation Commission have been dictated by the political agenda of the BJP -- to break the domination of the Muslim-majority Kashmir region in J&K assembly by creating more constituencies in the Jammu region (the districts of Samba, Kathua, Jammu and Udhampur) where the BJP is dominant.

Is the criticism justified?

The officials of the Delimitation Commission have justified the Commission's recommendations by pointing to **a provision of all the delimitation acts** from 1952 onwards. According to the provision, **other than population, factors like physical features, boundaries of administrative units, communication facilities and public convenience, should be taken into account while drawing constituency boundaries.**

According to them, the provision to consider factors other than population has always been adhered to. For example, Uttarakhand had all hill districts with 20% less population than the districts of the plains in the 2008 delimitation. Such provision is also available in Section 9 (1) (a) of the Delimitation Act, 2002, read with Section 60 (2) (b) of the J&K Reorganisation Act, 2019.

A former CEC and member of the last Delimitation Commission, **N. Gopalaswami,** said, "generally, delimitation is based on the population, but if there are issues that impede the smooth conduct of elections, they should be addressed: there could be a constituency split by a hill or the need to correct wrong delimitation in the past."

Delimitation : What, Why and How?

Delimitation is the act of redrawing the boundaries of electoral constituencies (seats) to represent changes in population over time. This may mean changes in the number of Lok Sabha seats allocated to a state as well as in the number of Assembly seats in each State.

This is necessary because the Constitution, under **Articles 81** and **170,** prescribes **proportional representation** (i.e. representation according to the population of each State and each constituency) with respect to both the House of People and each State assembly. The delimitation exercise should be carried out by such authority and in such manner as the Parliament may, under **Articles 82** and **170,** determine.

Therefore, the Parliament, after each Census, enacts a Delimitation Act under which the Union Government sets up a Delimitation Commission. The commission is headed by a retired SC judge and has members from the ECI and State Election Commissions. Its functions include:

1. Determining the number and boundaries of constituencies such that the population of all seats is the same, as far as practicable.
2. Identifying the seats to be reserved for the SC/STs, in areas where their population is significant.
3. The draft report is published in the Gazette of India, in the Gazettes of the States and in vernacular media seeking feedback from the general public.
4. Conducting public sittings wherein the public's opinion is heard through written or oral representations.
5. Its final order is notified in the Gazette of India and of its States forming the basis for all future elections till next delimitation.

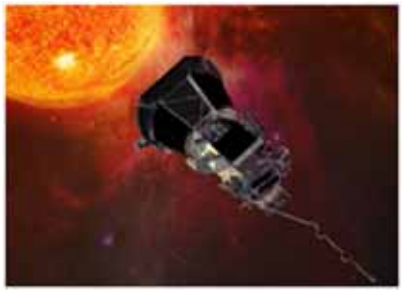
According to the latest **Delimitation Act of 2002,** "after publication in the Gazette of India, the delimitation orders of **the Commission shall have the force of law and shall not be called in question in any court.** After the publication, the order shall be placed before the House of People and the Assembly of the State concerned".

SCIENCE & TECHNOLOGY

SPACE

Parker Solar Probe

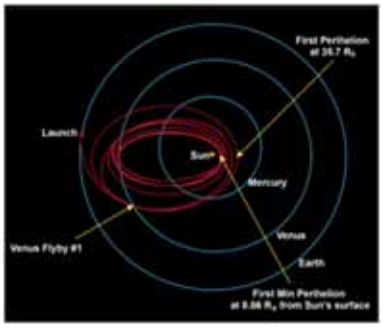
On December 14, 2021, during a meeting of American Geophysical Union, the scientists announced that for the first time, a NASA spacecraft has officially touched the sun, dipping, for a short while, into the corona (upper part of solar atmosphere).



The Parker Solar Probe actually crossed the **Alfvén critical boundary** (the outer edge of the corona) in April 2021 during its 8thflyby close to the Sun, but the analysis of data has only now confirmed it. Parker encountered the boundary at about 13 million km above the visible surface, or photosphere, of the Sun.

What is Parker Solar Probe?

Launched by NASA on 12 August 2018, the Parker Solar Probe is to make repeated passes of the Sun, getting in quickly and getting out quickly and making closest-ever observations of the Sun and origin of the solar wind.

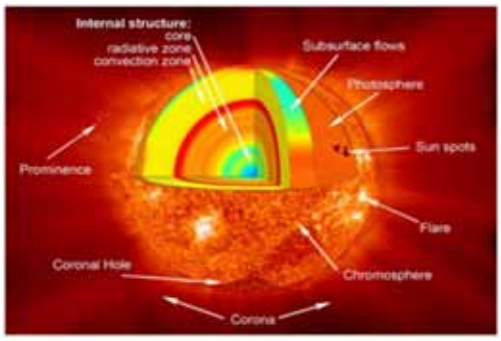


Parker Solar Probe will use seven Venus flybys over nearly seven years to gradually shrink its orbit around the Sun. At its closest approach, the spacecraft will come as close as 6.2 million km to the Sun's photosphere in 2025. So, the Parker probe will give much more data as it ventures ever deeper into the corona on future flybys of the Sun, moving at colossal speed of over 500,000 km/h.

It is the first major mission under the agency's **Living With a Star** program to study those aspects of the connected Sun-Earth system that directly affect life and society. Living With a Star is a cross-disciplinary program covering Space Science, Earth Science, Human Exploration and Development, Aeronautics and Space Transportation.

What is the Corona?

While the Sun's visible surface is known as **photosphere** and is roughly 6,000^{0}C, the Sun has an atmosphere whose lower part is called the **chromosphere** and whose upper part is called the **'corona'.** Both the chromosphere and the corona can be seen only during a solar eclipse.



The Sun's corona, which is much hotter than the Sun's photosphere, gradually turns into the solar wind, a flow of ionised gas (plasma) that moves outward through solar system into interstellar space. The solar wind is, in a sense, just an extension of the Sun's atmosphere that engulfs all the planets.

How important is it to study the corona? Why is a Solar Probe necessary to study it?

Solar winds are unpredictable in their intensity and frequency, often disturb our planet's magnetic field and can play havoc with satellite-based communications, and make power grids vulnerable to electrical surges.

The problem is, the fingerprints of the physical processes giving rise to the solar wind are erased by the journey the solar wind makes from the solar corona to Earth and beyond. Hence, the Parker has been launched into this region to reveal what is going on there so that the scientists try to forecast these "storms".

The science behind why the Solar Probe won't melt:

Temperature refers to how fast particles are moving, whereas heat refers to the total amount of energy that they transfer. High temperatures do not always translate to actually heating another object because particles may be moving fast, but if there are very few of them, they won't transfer much energy. Since space is mostly empty, there are very few particles that can transfer energy to the spacecraft.

The corona of the Sun has an extremely high temperature but low density. Hence, the surface of the heat shield that faces the Sun will only get heated to about 1,400^{0}C This is similar to the following example: if a person puts his hand in a hot oven, his hand receives less heat than it does when the person puts his hand in boiling water because in the oven, his hand has to interact with less number of particles.

What materials were used to protect the spacecraft from the solar heat?

Of course, even the temperature of 1,400^{0}C is as hot as the lava from a volcanic eruption. To withstand that heat, Parker Solar Probe has a heat shield called **Thermal Protection System,** which is 2.4 meters in diameter and 4.5 inches thick.While one side of the TPS faces the Sun, the other side has the spacecraft's key instruments at a comfortable 30^{0}C.

The TPS was built using a **carbon composite foam** sandwiched between two carbon plates. The sun-facing plate has **white ceramic paint** to reflect as much heat as possible. Other materials used in the spacecraft are the metals with high melting points such as **tungsten, niobium, molybdenum and sapphire.** Tungsten has the highest known melting point of 3,422^{0}C.

NASA's James Webb Space Telescope Launched

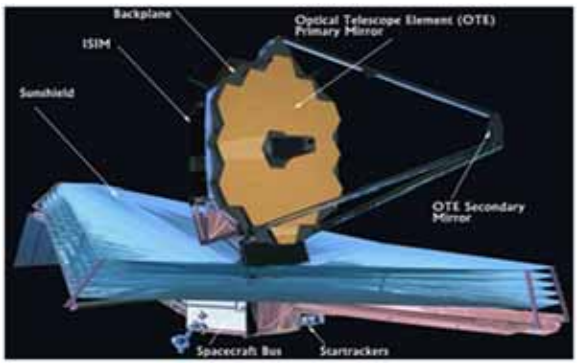
On December 25, 2021, NASA's **James Webb Space Telescope** was launched by the Ariane 5 rocket from European Space Agency's Spaceport in French Guiana, South America. Webb's objective over the next 5-10 years will be **to observe unseen distant parts of the universe and tell us how the early universe existed after the Big Bang.**

Webb will extend the discoveries of the Hubble Space Telescope which has been orbiting the Earth at an altitude of 570 km since 1990 when it was launched. After 29-day journey, Webb will be put in an orbit around the Sun (outside the Earth's orbit) at L2 point, a gravitationally stable position in space.

Named after the man who oversaw NASA through most of its formative decade (1960s), the JWST is a joint project of the NASA, the European Space Agency and the Canadian Space Agency.

What are the instruments?

The **Optical Telescope Element (OTE)** comprises the mirrors and other structures that support them. The OTE is the eye of Webb Telescope to gather the light coming from space and provides it to the science instruments. The **Integrated Science Instrument Module (ISIM)** onboard Webb has four scientific instruments:



1. Near-Infrared Camera (NIRCam),
2. Near-Infrared Spectrograph (NIRSpec),
3. Mid-Infrared Instrument (MIRI),
4. Fine Guidance Sensor/ Near InfraRed Imager and Slitless Spectrograph (FGS/NIRISS).

All these instruments, which operate at -223^{0}C, are protected from the Sun's heat by a tennis court-sized, kite-shaped **solar shield.** Temperatures on the sun-facing side of the sun shield can get as high as 110°C, while the other side where the key instruments are kept would be at -200° to -230°C.

The sun shield has 5 layers and each successive layer is cooler than the one below, because the heat radiates out from between the layers. One thick sunshield would conduct the heat from the bottom to the top more than five layers separated by vacuum.

What were the materials used?

Each mirror is made of **beryllium** coated with **gold,** because beryllium is very strong for its weight and holds its shape across a range of temperatures. Beryllium is a good conductor of electricity and heat and is not magnetic. Gold coating improves the mirror's reflection of infrared light.

Each layer of the sun shield is made of a lightweight material **Kapton** which remains stable across a wide range of temperatures from -269 to +400^{0}C Kapton has been coated with aluminium and doped silicon to reflect the sun's heat back into space.

How is Webb superior to Hubble?

Webb is about **100 times more sensitive** than Hubble and is expected to transform scientists' understanding of the universe and our place in it.

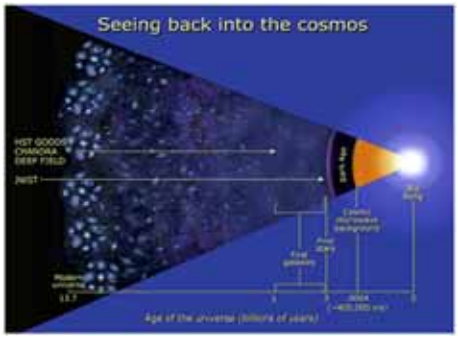
While Hubble observes light at primarily optical and ultraviolet wavelengths, **Webb is designed to detect primarily infrared light** which comes from more distant objects. Further, Webb's mirror is much larger (6.5 metres in diameter) than that of Hubble (2.4 metres in diameter) and will have about **7 times more light-gathering capability** than Hubble. Hence, Webb can see

much fainter objects than what Hubble can see. For example, Webb can see details on a 25 paise coin held at a distance of 40 km.

As the light takes nearly 8 minutes from the Sun to reach the Earth, the image of the Sun we see is about 8 minutes old. The Red giant star Betelgeuse (Thiruvathirai Nakshatra) is 548 light years away. Therefore, the light from this star must have begun its journey in the year 1473 AD. Thus, by looking far away, we look back in time. The farther away an object is, the farther back in time we are looking.

With its ability to detect infrared light rays, **Webb would look further back in time than Hubble** and tell us what is there. In other words, Webb would tell us what the early universe looked like when the earliest stars started to shine after the Big Bang about 13.5 billion years ago. Webb's spectroscope can also reveal the temperature and elemental composition and much more of early stars.

Why is an infrared telescope necessary to observe the ancient, distant stellar objects?



As electromagnetic waves travel far in space, they lose energy and their wavelength increases. An ultraviolet wave, for example, can slowly move into the visible light spectrum and the infrared spectrum, and further weaken to microwaves or radio waves, as it loses energy. Thus, aged light turns redder.

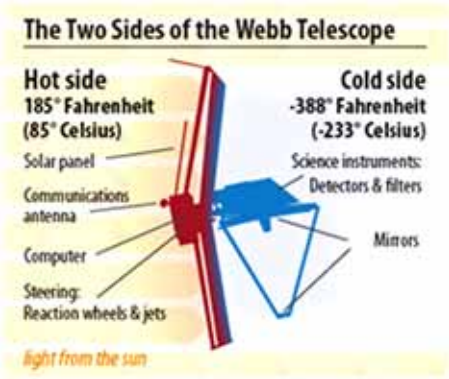
Since the Big Bang, the universe has been in constant expansion. As the universe expands, space stretches. The light from the earliest young stars and nascent galaxies was predominately visible and ultraviolet. However, after travelling the vast and expanding space, the light turns into infrared rays by the time it reaches the Earth. Further, the newly formed stars and planets are surrounded by a lot of dust that absorbs visible light coming from them. Only the infrared part of the light coming from them can penetrate such dust and make them visible to the telescope.

Hence, an infrared telescope, like Webb, is apt to observe the early universe.

Why should it be parked at Lagrange Point 2?

Lagrange point 2 (or 'L2') is located 1.5 million km directly 'behind' the Earth as viewed from the Sun. Normally, an object farther out from the Sun should move more slowly around the Sun. However, at L2, the extra gravitational pull of the Earth adds to that of Sun, and allows the object to move faster in unison with the Earth's yearly orbit. Thus, At L2, Webb will orbit the Sun at the same rate as the Earth. There are already several space observatories in this orbit.

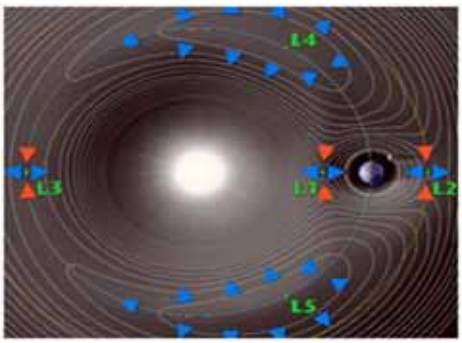
Telescopes are kept in space to avoid atmospheric disturbances and provide a clear, sharp images of objects in space. An infrared telescope must be cold enough to avoid emitting its own infrared radiation which interferes with the observations it makes in the infrared light. Hence, to



keep the Webb telescope cold (at -225^{0}C), the telescope has a solar shield to protect its mirrors and other instruments from the heat of the Sun, Earth, and Moon. For the solar shield to be effective, Webb needs an orbit where the sun and Earth are in the same direction. L2 is such a cold place. Also, parking a telescope always at the same spot in relation to the Earth and the Sun will enable **continuous communication with the telescope** through the Deep Space Network (DSN).

In comparison, the Hubble Telescope, which is in low-Earth orbit, goes in and out of the Earth's shadow every 90 minutes. Hubble's view is blocked by the Earth for part of each orbit. Hubble is also subject to thermal fluctuations.

What are Lagrange points?



Lagrange points are positions in space where an object sent there tends to stay put, because the object experiences the equal gravitational pull from two large bodies. These can be used by spacecraft as "parking spots" in space to remain in a fixed position with minimal fuel consumption. There are 5 such points in and around the Earth's orbit.

Study of Magnetars

Scientists have for the first time managed to measure the characteristics of a flare on a distant **magnetar,** a rare compact type of neutron star that has the most intense magnetic field known.

Within a few tenths of a second, the flare released as much energy as the Sun would shed in 100,000 years, and this flare was captured accidentally on April 15, 2020, by the International Space Station.

This data was then analysed by the researchers over a year to throw light on the structure of the flare, and thereby, on the nature of such magnetars. This is the first study to characterise such a flare from so distant a magnetar.

How do magnetars form?

Massive stars - with masses around 10-25 times the mass of the Sun - eventually die in supernova and shrink to form **neutron stars,** very small and super-dense stars mostly comprising tightly packed neutrons.

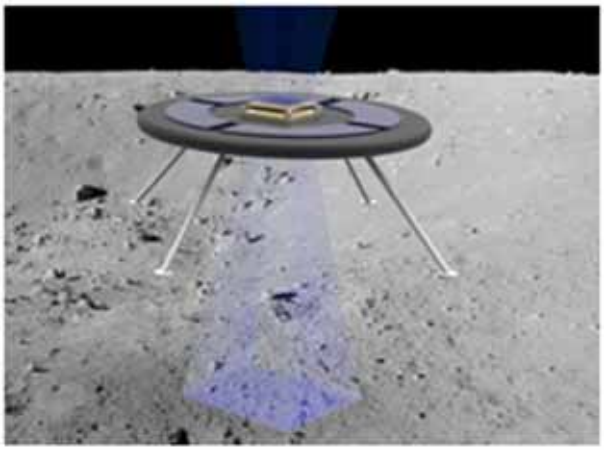
Some of them are highly dense and have breathtakingly high rotational periods (just 0.3-12 seconds). Such neutron stars possess intense magnetic fields and are known as magnetars. Their size is around 20 km in diameter with mass around 1.4 times that of the Sun.

They can be observed only when they emit short-lived violent flares. Studying these flares will help understand the physics of magnetars but also the mysterious **Fast Radio Blasts** (bursts of radio waves produced in the magnetar's flare-ups).

Engineers Design a Levitating Rover to explore Airless Moon

The aerospace engineers of the Massachusetts Institute of Technology (MIT) are testing a concept for developing a rover that hovers or levitates over the surface of the Moon or other airless cosmic bodies by harnessing the natural charge of these bodies.

The levitating rover would have no wheels or moving parts and could go over asteroids whose terrain is highly uneven and rough.



Scientific basis:

In the absence of an atmosphere, the Moon and other cosmic bodies can build up an electric field through direct exposure to the sun and surrounding plasma. On the Moon, this surface charge is strong enough to levitate dust more than one metre above the ground - just like how static electricity can cause a person's hair to stand on end.

Researchers have proposed harnessing this natural surface charge to levitate a **glider with wings made of Mylar,** a material that naturally holds the same charge as surfaces on airless bodies, because the similarly charged surfaces should repel each other, and this force takes the glider off the ground.

But such a design would likely be limited to small asteroids, as larger planetary bodies would have a stronger gravitational pull that counteracts the repulsive force. The MIT team's levitating rover could get around this limitation by boosting the surface's natural charge through tiny ion beams.

In an initial feasibility study, the researchers show that such an ion boost should be strong enough to levitate a small, 1 kg vehicle on the Moon and large asteroids like Psyche.

DEFENCE

Pinaka Extended Range Rockets Successfully Tested: DRDO

Between December 9 and 11, 2021, at Pokhran range, the DRDO, along with the Army, conducted a series of performance evaluation trials of these industry-produced rockets at field firing ranges. In these trials, **Pinaka Extended Range** rockets were successfully test-fired at different ranges with various warhead capabilities.

The Extended Range version of Pinaka, primarily a multiple rocket launcher, has a range of 45 km. The Panika-ER was tested along with its two ancillary systems - Area Denial Munitions (ADM) and indigenously developed fuses for Panika rockets. ADMs are a category of ammunition used to prohibit the adversary from occupying or passing through a particular area. The indigenously developed fuzes will replace the imported fuzes.

The DRDO, after establishing the performance efficacy of Pinaka-ER, transferred the technology of the system to the industry partner which has manufactured Pinaka-ER with DRDO's help. These trials are part of performance evaluation under technology absorption.

Supersonic Missile Assisted Release of Torpedo (SMART) Tested Successfully

On December 13, 2021, the DRDO successfully tested a long-range Supersonic Missile Assisted Torpedo (SMART) from Abdul Kalam island (formerly called Wheeler Island), off the Odisha coast.

When launched from a ground mobile launcher (a warship or a truck on the coastal battery), the SMART takes off like a regular supersonic missile covering most of its flight in the air at lower altitudes. Just when it approaches the submerged submarine, the missile will eject the torpedo system into the water and the autonomous torpedo will start moving towards its target submarine to destroy it.

This next-generation missile-based standoff torpedo delivery system has been designed to enhance anti-submarine warfare capability far beyond the conventional range of the torpedo. A stand-off missile is one that may be launched from a distance sufficient to allow the attackers to evade defensive fire from the target area.

This missile test follows a series of indigenous stand-off weapons being tested for the IAF in recent times - the Long-Range Bomb (LRB), the Smart Anti-Airfield Weapon (SAAW) and the Stand-off Anti-Tank (SANT) missile.

Agni-P Missile Tested Successfully for the Second Time: DRDO

On December 18, 2021, the DRDO successfully tested the nuclear capable ballistic missile Agni Prime (or Agni-P). This is the second time the surface-to-surface missile was tested this year after June.

Agni-P is an advanced variant of Agni class of missiles with improved maneuverability and accuracy and with a range of 1000-2000 km. The missile is canisterised, which means that the missile is capable of launch at short notice because its storage and handling features have been improved.

Other Agni missiles operationalised:

1. **Agni I:** with range of 700-800 km.
2. **Agni II:** with range of more than 2000 km.
3. **Agni III:**with range of more than 2,500 Km
4. **Agni IV:**with range of more than 3,500 km.
5. **Agni-V:** an Inter-Continental Ballistic Missile (ICBM) with a range of over 5,000 km.

Significance of Agni missiles:

Agni class of missiles are the mainstay of India's nuclear launch capability, which also includes the Prithvi short-range ballistic missiles, submarine launched ballistic missiles and fighter aircraft. In the last few years, India has operationalised its submarine-based nuclear launch capability, completing the nuclear triad, a three-sided military-force structure consisting of land-launched nuclear missiles, nuclear-missile-armed submarines, and strategic aircraft with nuclear bombs and missiles.

Maiden Test of Pralay Surface-to-Surface Missile Successful: DRDO

On December 22, 2021, the DRDO successfully conducted the maiden flight test of indigenously developed **surface-to-surface quasi-ballistic missile 'Pralay',** from the Abdul Kalam Island off Odisha coast.

The missile has a range of 150-500 Kms. A quasi missile trajectory is also ballistic but after certain range it changes the projectile path to defeat interceptors.

The missile is powered with solid propellant rocket motor and many new technologies. Accuracy is a highlight of this missile, which has the latest navigation system and integrated avionics.

Capable of being launched from a mobile launcher, the missile, once inducted in the Army, will be the longest range short-range ballistic missile (SRBM) in its inventory and will give a big boost to its tactical battlefield strategy.

India will have two conventional missiles with long range. While Pralay will be the ballistic option, the BrahMos will be the cruise option. The BrahMos supersonic cruise missile has a range of 290-plus km, and is deployed in strategic locations along the de-facto border with China in Ladakh and Arunachal Pradesh.

Ballistic missile vs Cruise missile:

The ballistic missiles are basically projectiles whose trajectory follows the laws of gravity. Though initially guided by rocket(s) for 3-5 minutes, a ballistic missile later begins unpowered flight and continues to ascend (much higher than satellites or space stations in low Earth orbit), re-enters the atmosphere and falls on the target under gravity. All of the Prithvi and Agni series are ballistic. Based on their range, ballistic missiles are classified into:

1. **SRBMs:** short-range or tactical ballistic missiles (below 1000 km). Eg. all the variants of Prithvi are SRBMs.
2. **MRBMs:** medium range ballistic missiles (1000-3000 km). Eg. Agni I-II missiles
3. **IRBMs:** intermediate range ballistic missiles (3000-5500 km). Eg. Agni III-IV.
4. **ICBMs:** inter-continental or long-range or strategic ballistic missiles (above 5500 km). Eg. Agni V can reach up to 8000 km while Agni-VI which is under development can reach up to 12000 km.

In contrast, cruise missiles are guided throughout their trajectory and don't fall freely. With extremely high accuracy, these are self-navigating and can fly as low as a few metres. Flying low to the ground takes more fuel but makes the missiles very difficult to be detected by the enemy country's radar system. Brahmos (with a range of 500 km) and Nirbhay (with a range of 800 km) are cruise missiles of this kind.

Though both can carry nuclear or conventional payloads, they have their own advantages and disadvantages. Ballistic missiles have the advantage of speed and countering them is difficult though their detection makes them vulnerable to missile defence systems. Cruise missiles have high agility, stealth and even loitering capability. Remote operators can use a camera in the nose of a cruise missile to see what the missile sees. This gives them the option to guide the missile to its target or to abort the strike.

Growth of India's Defence Exports

Minister of State for Defence Ajay Bhatt said in a written reply to the Rajya Sabha, "India's defence exports have increased from Rs.1,521 crore in 2016-17 to Rs. 8,434.84 crore in 2020-21 (they were Rs. 10,745 crore in 2018-19)".

According to the Swedish think tank Stockholm International Peace Research Institute (SIPRI), three Indian companies figure among the top 100 defence companies in its 2020 rankings - **Hindustan Aeronautics Limited (HAL), Ordnance Factory Board and Bharat Electronics Ltd (BEL).**

In February 2021, Defence Minister announced that India was ready to supply different missile systems, helicopters, light transport aircraft, warships and patrol vessels, artillery guns, tanks, radars, military vehicles, electronic warfare systems to the nations of Indian Ocean Region. The PM said, "being good at low-cost, high-quality production, we are exporting to over 40 nations now, and have to emerge as a global exporter".

India is traditionally one of the largest importers of arms globally. However, the government now wants to reduce dependence on imported military platforms and decided to support the domestic defence manufacturing.

Policy steps to boost defence production:

The measures announced since 2014 to boost exports include simplified defence industrial **licensing,** relaxation of **export controls** and grant of no-objection certificates.

Specific incentives were also introduced under the foreign trade policy and the Ministry of External Affairs has facilitated **Lines of Credit** for countries to import defence products.

The draft Defence Production and Export Promotion Policy 2020 has set a **target to achieve exports of about Rs. 35,000 crore** ($5 billion) in aerospace and defence goods and services by 2025.

Since 2020, a percentage of the capital outlay of the **defence budget** has been reserved for procurement from domestic industry. This was 63% for 2021-22.

To boost indigenous manufacturing, the Government has a **positive indigenisation list of items** that cannot be imported and can only be procured from domestic industry. It already has notified three such lists of items to be indigenised. The list currently includes over 2,500 items and many more will be added.

Thus, in the next 4-5 years, India will have a lot of indigenous content in its armed forces.

Rustom-II UAV crosses Important Milestone

On December 15, 2021, the DRDO announced, "India's indigenous **Medium Altitude Long Endurance Unmanned Aerial Vehicle program,** called Rustom-II, achieved a milestone in its development by reaching an altitude of 25,000 feet and an endurance of 10 hours. Thus, it moved a step closer towards production.

Primarily these drones are utilised for Intelligence Surveillance and Reconnaissance purpose but can be modified for other uses. They technologically match contemporary UAVs and will also be cheaper than the imported ones.

High endurance UAVs are a priority for the armed forces especially in the standoff with China in Eastern Ladakh. The armed forces rely heavily on the Israeli Searcher and Heron drones and need more such UAVs.

HEALTH

State Health Index: Kerala best, UP worst

On December 27, 2021, NITI Aayog released the 4th edition of the **State Health Index for 2019-20,** titled **"Healthy States, Progressive India".**

About the index:

- The annual index ranks States and UTs on their year-on-year performance in health outcomes.
- It is a weighted composite index based on **three broad types of indicators** -

- 'Health Outcomes' (neonatal mortality rate, under-5 mortality rate, sex ratio at birth, etc).
- 'Governance and Information' (such as institutional deliveries, occupancy of senior officers in key posts earmarked for health), and,
- 'Key Inputs/Processes' (shortfall in health care providers, functional medical facilities, birth and death registration and tuberculosis treatment success rate).

Findings:

- For the 4th year in a row, **Kerala** has ranked first, followed by **Tamil Nadu & Telangana.** While **UP** is at the bottom, **Bihar** and **MP** are the second and third worst performers
- 47% of States showed the highest progress in health outcomes and governance and information, while only one State showed the highest progress in the key inputs and processes domain.
- The better performing States such as Kerala, Tamil Nadu, Telangana, AP and Maharashtra performed comparatively better on the health outcomes, but performed badly on key inputs and processes.
- The greatest progress from 2018-19 to 2019-20 was made by Telangana, followed by Gujarat and Panjab.
- On the other hand, five States including Odisha, AP, Himachal Pradesh, Karnataka and Uttarakhand declined in their ranking.

Covovax, Corbevax and Molnupiravir get Emergency Use Authorisation

On December 28, 2021, Union Health minister said, "the Central Drugs Standard Control Organisation (CDSCO) has approved two more vaccines - Covovaxand Corbevax - and an anti-viral drug Molnupiravir for restricted use in emergency situation.

Corbevax, a protein sub-unit vaccine, is made by Hyderabad-based **Biological-E,** and Covovax is manufactured by **Serum Institute of India** under licence from Novavax, a U.S.-based biotech company. Corbevax has been co-developed by **Biological E** and two American companies, Baylor College of Medicine and Dynavax Technologies.

Molnupiravir inhibits SARS-CoV-2 replication by viral **mutagenesis,** a process by which the genetic information of an organism is changed by mutation. It can be easily administered as a pill and particularly helps those with mild-to-moderate disease. However, later (January 11, 2022) the ICMR has decided against including it in its Clinical Management Protocol for Covid-19.

Currently, India uses Covishield, Covaxin and Sputnik V in its vaccination programme against Covid-19.

- **Covishield** has been developed by the Oxford University and British-Swedish company AstraZenecab, and is manufactured by India's Serum Institute of India.
- **Covaxin** was developed by Bharat Biotech in collaboration with the ICMR's National Institute of Virology. It is also made by Bharat Biotech.
- **Sputnik V:**it is the world's first vaccine against Covid-19 developed by Russia. 'V' in the name refers to 'Victory' over COVID-19.

DGCA Revises Guidelines on Breath Analyser Tests

On December 21, 2021, the Directorate General of Civil Aviation issued revised guidelines for pre-flight and post-flight breath analyser tests on the crew.

The DGCA said, "even when the blood alcohol levels are zero in the body, there could be some hangover effect. This is mainly due to **congeners** which may take 15-18 hours to get dissipated and may produce ill effects for up to 36 hours depending upon the amount of alcohol consumed. Alcohol also interfered with the enzymatic cellular process or oxidation, causing **hypoxia** and reduced an individual's tolerance with increase in altitude".

What are congeners?

They are **substances other than ethanol that occur naturally in alcohol beverages** as a result of distilling and fermenting processes.

BIOTECHNOLOGY:

Nit glue produced by Head Lice emerges as a New Source of Ancient Human DNA

On December 28, 2021, the scientists, for the first time, recovered ancient human DNA from the **cement on hairs taken from mummified human remains** (in South America) that date back 1,500-2,000 years.

This recovery is possible because skin cells from the scalp become encased in the cement or sticky substance produced on our hair by female lice to attach their eggs (known as nits) to the hair.

Demand for DNA samples from ancient human remains has grown in recent years as we seek to understand migration and diversity in ancient human populations.

How significant is the discovery?

Until now, ancient DNA has preferably been extracted from dense **bone** from the skull or from inside **teeth.** However, skull and teeth remains are not always available. Recovering DNA from the cement delivered by lice is thus a solution to the problem.

Headlice have accompanied humans throughout their entire existence, and the eggs (or nits) of lice are commonly found on the hair and clothes of well-preserved and mummified humans. DNA in the glue of the nits seems preserved or protected better from chemical damages, [compared to DNA found in the tooth or bone].

E.O. Wilson, Modern-Day Darwin, dead

On December 26, 2021, Edward. O. Wilson, a pioneering U.S. scientist dies at age 92. His study of insects and his call to protect Earth earned him the nickname **"Darwin's natural heir",** has died at age 92 in Massachusetts. He also advised preeminent scientific and conservation organisations.

The biologist and Harvard University research professor was considered the world's leading authority on ants and their behavior. Later he went onto to study the social interaction of birds, mammals and humans, thus establishing a new field of science called Sociobiology.

In his 1975 book **Sociobiology,** he laid out his theory of animal behavior. In the final chapter, he controversially proposed that **human behavior is largely genetically based, and that humans acquire a predisposition to such matters as the division of labour between genders, tribalism, male dominance and parental-child bonding.**

India's Semiconductor Mission

On December 15, 2021, the Cabinet approved a **76,000-crore comprehensive program for the sustainable development of various semiconductor goods and display manufacturing ecosystem in India.**

The schemes under this program were later notified on December 21 and guidelines issued on December 30. The schemes are:

1. Fiscal support up to 50% of the cost of setting up **semiconductor fabs and display fabs** in India to eligible businesses. 'Fabs' mean fabrication or manufacturing plants.
2. Upgrading **Semi-conductor Laboratory, Mohali.**
3. Fiscal support of 30% of the capital expenditure to approved units for setting up **compound semiconductors/silicon photonics/sensors fabs** as well as **semiconductor ATMP and OSAT facilities** in India. (ATMP = assembly, testing, marking, and packaging, while OSAT = outsourced semiconductor assembly and test).
4. **Design Linked Incentive (DLI) scheme:** to extend product design-linked incentive of up to 50% of eligible expenditure and product deployment-linked incentive of 4-6% on net sales for 5 years. The Government supports 100 domestic companies that design semiconductorsand get the designused in the manufacturing process.

The Scheme for Setting up Semiconductor Fabs and Display Fabs will be implemented through a **India Semiconductor Mission)** headed by 'global industry experts' to drive long-term strategies for the sustainable development of the semiconductors and display industry. Under the scheme, the Centre would work with the States to set up high-tech clusters with the necessary infrastructure such as land and semiconductor-grade water.

With the approval of the 76,000-crore program, the Government has committed **2.30 crore** to positioning India as global hub for electronics manufacturing with semiconductors as the foundational building block. Earlier, the Government has announced the 55,392 crore incentives under:

1. **Production-Linked Incentive (PLI) Scheme for Large-scale Electronics Manufacturing,** launched in 2020.
2. **PLI for IT Hardware,** launched in March 2021.
3. **Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS),** launched in 2020.
4. **Modified Electronics Manufacturing Clusters (EMC 2.0) scheme,** launched in 2020.

All this is in line with the **National Policy on Electronics 2019 (NPE 2019),** aimed at positioning India as a global hub for Electronics System Design and Manufacturing (ESDM) and enabling the industry to compete globally. It also envisages creation of a vibrant semiconductor design ecosystem.

What are semiconductors? And what is their use in modern economy?

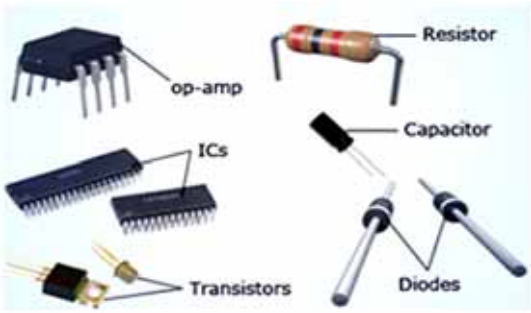
Semiconductors are materials whose electrical conductivity ranges between conductors (generally metals) and non-conductors or insulators (such as most ceramics). Semiconductors can be

pure elements, such as silicon or **germanium,** or compounds such as **gallium arsenide or cadmium selenide.**

The conductivity of pure semi-conductors (silicon or germanium) can be changed greatly by adding small amounts of impurities to them in a process called 'doping'. Boron, arsenic, phosphorus, and gallium are used to dope silicon, the most common semiconductor.

Semiconductors are used for designing electronic components. The most common such component is the **Diode,** which allows the flow of current in one direction only and thus acts as a one-way electronic valve. After the diode, **transistor** was invented, which is used for fast switching or current amplification.

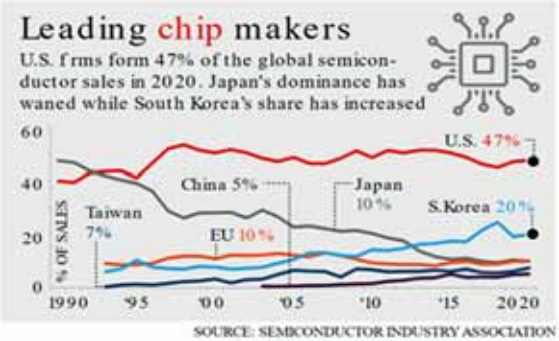
The invention of diode & transistor paved the way for the design of integrated chips, the building blocks of every electronic device. An integrated circuit is a small chip of a semiconductor material, usually silicon, on which thousands of electric components including transistors, diodes, resistors, etc. are embedded or fabricated, thus forming a miniaturized electronic circuit.



Need for manufacturing semiconductor goods in India:

Electronics permeates all sectors of the economy and is expected to grow further along with the emerging technologies including 5G, IoT, AI, Robotics, etc. Therefore, trusted sources of semiconductors, the building blocks of electronic devices, are key to the security of critical information infrastructure to ensure the digital sovereignty of India.

Currently, the bulk of semiconductor manufacturing capability is concentrated in a few countries including Taiwan, South Korea, U.S., Japan and, more recently, China. The pandemic has, on the one hand, disrupted the supply chain of semiconductors, badly affecting a range of manufacturing industries such as cars, laptops and phones. On the one hand, the Covid-19 pandemic has taken much of daily economic and essential activity online highlighting the centrality of the chip-powered computers and smartphones in people's lives. Hence, Governments worldwide have started treating chip manufacturing as a strategic imperative.



Currently, India entirely depends on imports for semiconductor goods and the disruption in their supply chainhas resulted in the capacity-underutilisation for MSMEs in the electronics manufacturing industry. For example, production for carmakers, one of the biggest users of semiconductor chips, has fallen to 40%. Our dependence on China is another concern - all the chips for the LED bulbs that are manufactured in India come from China.

In such scenario, over the next 4-5 years, the scheme would boost the development of a complete semiconductor ecosystem, ranging from design, fabrication, packaging, and testing. Apart from the strategic advantages such as reduced reliance on imports, the scheme is expected to create 35000 specialised jobs.

What are the challenges?

The challenge ahead, however, is fairly daunting. For one, the fiscal support currently envisioned is minuscule given the scale of investments typically required to set up capacities in the semiconductor manufacturing industry.

Even if the first scheme (for setting up semiconductor fabs and display fabs) gives only 50% of the cost of setting up at least two greenfield semiconductor fabs by fiscal support, not much of the current scheme outlay - 76,000-crore - is likely to be left to support other elements including display fabs, packaging and testing facilities, and chip design centres.

Chip fabs are also very thirsty units requiring millions of litres of clean water and extremely stable power supply. It may be best if the new program focuses fiscal support, for now, more on chip design, where India already has considerable talent and experience.

Superconducting Fault Current Limiter (SFCL)

Researchers from IIT, Kanpur developed an innovative variation of the superconducting fault current limiter (SFCL) to protect power grids against sudden, unexpected current surges.

Previously, the fault current (sudden surges in the current) used to be controlled by using circuit breakers, which would cut off the current in the event of a surge. But their response time to the current surge was too large and once the circuit was broken to avoid accident, the switch had to be manually turned on once again.

In developed countries, a new way to tackle this has been developed - the superconducting fault current limiters (SFCL). It uses a superconductor, which offers zero resistance to the current under normal circumstances. However, if the current flowing through it increases beyond a threshold value, its resistance increases sharply. Once the current falls below the threshold, the resistance of the SFCL also automatically goes down to zero.

The imported SFCL devices cost around a million Euros. The prototype **"smart" SFCL** developed by these researchers cuts this cost by 50%-60%. This smart version of SFCL not only shields the grid from large current surges and consequent fire accidents, but it can also sense when the current surges will happen and warn the system about it.

What is a superconductor?

It is a substance that conducts electricity without resistance when it becomes colder than a "critical temperature." At this temperature, electrons can move freely through the material.

Note: this article is more important for the Prelims. Just understand what is a superconductor? And what an SFCL is?

Atal Ranking of Institutions on Innovation Achievements (ARIIA) 2021

On December 29, 2021, Union Minister of State for Education virtually announced the Atal Ranking of Institutions on Innovation Achievements (ARIIA) 2021.

The ARIIA 2021 classifies all major educational institutions into technical and non-technical, and ranks them on various **parameters** related to Innovation, Start-up and Entrepreneurship Development" amongst students and faculties.

In the technical category, for the third time, **IIT (Madras)** has secured the first rank as the most innovative in the country. Seven institutions from **Maharashtra** have secured 'Top 10' positions in various categories such as centrally-funded institutions, state-funded universities, etc.

In comparison, the NITI Ayog's latest **India Innovation Index, 2020** ranks States and UTs based on their overall innovation environment, based on human capital, investment, business environment in the respective States.

Significance of innovation:

- Innovation is a process whereby people develop new ideas or existing ones to create new products and processes as the solutions to everyday practical problems.
- Innovation has never been as important as today, as the contemporary economies are more influenced by ideas, than they are governed by capital and labour.

As a result of various initiatives, India is constantly improving on **Global Innovation Index (GII)** and has moved up to 46thposition in 2021 from 81stin 2015.