Science and Technology Class 14

29th August, 2023 at 9:00 AM

INTEGRATED GUIDED MISSILE DEVELOPMENT PROGRAMME (09:10 AM)

- It was envisaged by Dr APJ Abdul Kalam.
- The mission started in 1983 and was completed in 2008 by DRDO.
- **5 missile systems were developed as part of the plan-**
- Prithvi
- Akash
- Trishul
- Nag
- Agni
- **Agni V-**
- It is the most powerful missile in India. It is an ICBM (Inter Continental Ballistic Missile) with a range of 6000 km powered by 3-stage rockets. All stages have solid fuel.
- It is capable of carrying 1.5 tonnes of nuclear warhead.
- It can be launched using a **canister mechanism** which helps in quick response, and longer shelf life and the canister launch can further increase the range of the missile.

BARHMOS MISSILE (09:25 AM)

- It is a **supersonic** cruise missile developed in collaboration with Russia.
- It is named after the Brahmaputra and Moskva rivers.
- It is a **two-stage missile** with solid propellant booster and liquid Ramjet.
- It can be launched from land, air and sea.
- The range is about 600 km.

BALLISTIC MISSILE DEFENCE PROGRAM (09:35 AM)

- DRDO is developing a two-tier Ballistic Missile defence system to provide a shield against Ballistic missile attacks.
- The first tier is called **Prithvi air defence** which will try to neutralise an incoming threat outside the atmosphere and the second tier is called **advanced air defence** which will try to neutralise an incoming threat within the atmosphere.
- India is buying an **S-400 system** from Russia which is a **4-tier air defence system** capable of neutralising multiple air threats such as drones, fighter jets, cruise and Ballistic missiles simultaneously.

SUBMARINES AND SHIPS (09:46 AM)

- Submarines are naval vessels capable of propelling itself beneath the water as well as on the water's surface.
- There can be **two types of submarines-**
- **a) Diesel-electric powered**
- Initially, submarines were bought from Russia. E.g. INS Sindhughosh, Sindhuvijay, Sindhurashtra etc.
- **From France-**
- An MoU between DCNS and Mazgaon Doc Ltd has led to six scorpene class submarines as part of the Make in India program and Project 75 I of the Indian Navy.
- **E.g.** INS Kalveri, INS Karanj, INS Kandheri, INS Vela, INS Vagir, INS Vagsheer.
- Scoropene class submarines are fast attack submarines, that can sustain high water pressure, have very low acoustics, and thus can not be easily identified by SONAR.
- **Fuel cell technology-based:**
- It will use hydrogen to power the submarine.
- **b) Nuclear-powered Submarines**
- Nuclear-powered submarines are powered by small nuclear reactors and thus can stay inside water for a very long duration.
- INS Arihant is an indigenously developed nuclear-powered submarine using a pressurised water reactor.
- It is capable of carrying a nuclear-tipped ballistic missile called K4 missile.
- **India has achieved a nuclear triad** with INS Arihant i.e. it can launch nuclear missiles from air, water and land.

TORPEDOES (10:13 AM)

- These are underwater missiles.
- **E.g.** Varunastra developed by DRDO.
- **Mareech**, developed by DRDO is an advanced torpedo defence system for torpedo defence system and countermeasures.

NAVAL WARSHIPS (10:15 AM)

- They can be divided into 4 categories-
- **1) Destroyers**
- These are large warships equipped with missiles and torpedoes.
- They also have Radar systems and Sonar systems.
- E.g. INS Kolkata, INS Vishakhapatnam, INS Murmugao.
- **2) Frigates**
- These are smaller but faster than destroyers.
- They have both offensive and defensive capabilities.
- They can be used to escort larger ships.
- **E.g.** INS Shivalik, INS Brahmaputra, INS sahyadri.
- **3) Corvettes**
- It is a small class of combat ship, often the smallest in any fleet.
- They have a limited range and weapon systems and are primarily used for naval police to patrol the sea and for the defence of a larger ship.
- **E.g.** INS Kavarati, INS Kamorta.

- **4) Aircraft carriers**
- They are floating air bases in the sea mainly fighter aircraft operating from their decks.
- They are accompanied by Destroyers, Frigates, submarines etc.
- **E.g.** INS Vikrant and INS Vikrmaditya.
- Despite a smaller airstrip, **fighter jets can land and take off because of the following two mechanisms:**
- **a) Short takeoff but arrested recovery (STOBAR)**
- The frontal part of the deck is elevated which provides an assist like a ski jump.
- Both INS Vikrant and Vikramaditya are examples of the SToBAR mechanism.
- **b) Catapult-assisted takeoff but arrested recovery**
- High-strength wires are placed on the deck.
- The fighter jet has a tailhook that gets arrested in one of the wires and decelerates rapidly.

STEALTH TECHNOLOGY (11:00 AM)

- Radars send out electromagnetic signals as short pulses which may be reflected by objects in their path (in part reflecting back to the radar).
- Thus, Radars work on echo and Doppler shift.
- SONARs works on the same principle but instead of radio waves, it uses sound waves.
- The goal of stealth technology is to make an aircraft, ship or submarine invisible to RADARs and SONARs.
- There are many **ways to achieve stealth capability** such as:
- i) The aircraft can be shaped in a way that RADAR signals are scattered away from the RADAR equipment.
- ii) Aircraft can be covered in materials that can absorb RADAR signals.
- iii) Use of Radio Jammers which create a lot of noise on the RADAR frequency effectively neutralising it.

FIGHTER CRAFTS (11:27 AM)

- **From Russia-**
- MiG21
- MiG29
- Sukhoi Su30.
- **From France-**
- Mirage
- Rafale
- **Indigenous-** LCA Tejas by HAL
- Tejas is one of the lightest and smallest supersonic fighter aircraft in its class.
- It carries air-to-air precision-guided weapons.
- It has air-to-air refuelling capability.
- It will fly with a maximum speed of Mach 2.

AIRBORNE EARLY WARNING AND CONTROL (AEW&C) (11:39 AM)

- It is an airborne RADAR system designed to detect aircraft, ships, and missiles.
- IAF has 5 airborne warning aircraft- 3 of Israeli origin called Falcon and 2 indigenous called Netra.

DIRECTED ENERGY WEAPONS (11:48 AM)

- It is a ranged weapon that damages its target with a highly focused energy beam without a solid projectile.
- For **example**- Laser electron beams, sound beams etc.
- DRDO is reported to have developed **Mission KALI (Kilo Ampere Linear Injector).**
- Once a missile launch is detected, KALI is supposed to quickly emit powerful pulses of electrons that can damage electronic systems onboard.

WEAPONISATION OF SPACE (11:59 AM)

- It entails putting weapons in space or on celestial bodies along with developing weapons that can travel across space as well as from Earth to destroy targets in the outer spectrum.
- It can include orbital ballistic missiles, directed energy weapons to destroy a satellite, anti-satellite capability, and launching a weapon into space to destroy a target in space or on the ground.

TOPIC OF THE NEXT CLASS- INTELLECTUAL PROPERTY RIGHTS