

Role of Technology in National Security

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National Security Challenges

- External on borders
- Internal in streets
 - Cyberterrorism
 - Bioterrorism
 - Radiological terrorism

Traditional Ways of National Security

- Protecting and securing the physical survival of the state from external (military) threats
- Protecting territory from foreign invasion



Role of Technology in National Security

- To wage war by pinpointing a human target from thousands of miles away with an unmanned aerial drone,
- To disrupt a nuclear program with a computer virus,
- To genetically engineer in a kitchen a highly virulent pathogen that could kill millions

Role of Technology in National Security

Technology can be used for the protection of national integrity and from enemies. Technology is used for National Security in the following ways:

- For Spying
- For communication purpose
- For defense purpose
- For tackling Natural Disasters

SPYING

Stealth Technology:

Stealth aircraft use stealth technology to avoid detection by employing a combination of features to interfere with radar as well as reduce visibility in the infrared, visual, audio and radio frequency (RF) spectrum.



COMMUNICATION

Communication equipment are built to encrypt and decode transmissions and survive rough treatment in hostile climates. They use many frequencies to send signals to other radios and satellites.



Technology in DEFENSE Sector

- Defense sector uses all kinds of latest technology for its day to day working
- It Ranges from Computer Servers to Heat Seeking Missiles



DISASTER

Transport systems technology:

- It takes use of helicopters and unmanned helicopt and weaponry

Night Vision device:

- Helicopters and Unmanned Arial Vehicles (UAV) for surveillance
- Air force uses Bombers like B2, F-16, Sukhoi etc



Biometric technology

- It is referred to identification of humans by their characteristics or traits.
- It is science of measuring and analyzing biological data. It measures and analyze human body characteristics such as DNA, finger prints, eye retinas, voice patterns and facial patterns etc



Armored Fighting Vehicle [AFV]



- An armored fighting vehicle (AFV) is a military vehicle, protected by Armour and armed with weapons.
- AFV's can be wheeled or tracked, depending on terrain and service conditions.

Military Armor

- With so many soldiers killed or injured by roadside bombs and IEDs over the past half-decade, intensive research has been devoted to improving the body armor worn by troops sent into harm's way.
- Nanoparticle armor to protect not only soldiers, but the vehicles they ride in.
- By infusing nanoparticles into ceramic materials used in military armor, both porosity and structural strength are increased.
- It is hoped that the improved armor is perfected and introduced as soon as possible.



Arjuna MBT



- DRDO's indigenous battle tank.
- The futuristic technology systems include:
 - automatic target tracking.
 - defensive aids.
 - Laser warning.
 - They are looking at developing robotic vehicles that would work
 - Always on tele-link.

Missiles Technology:

- It is a self-propelled guided weapon system. Missiles have below system components:

Targeting, flight system and engine

- Missiles are for different purposes:

- ❖ Surface to Surface

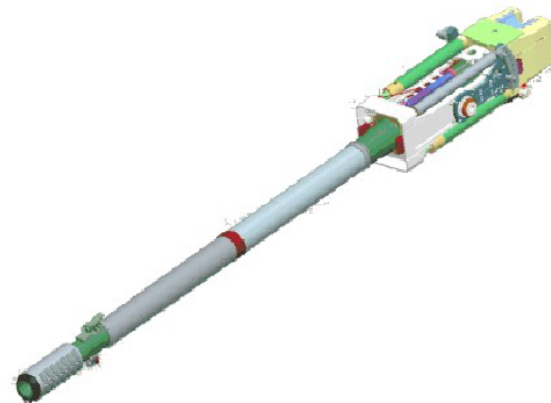
- ❖ Air to Surface

- ❖ Surface to Air

- ❖ Anti-satellite missiles

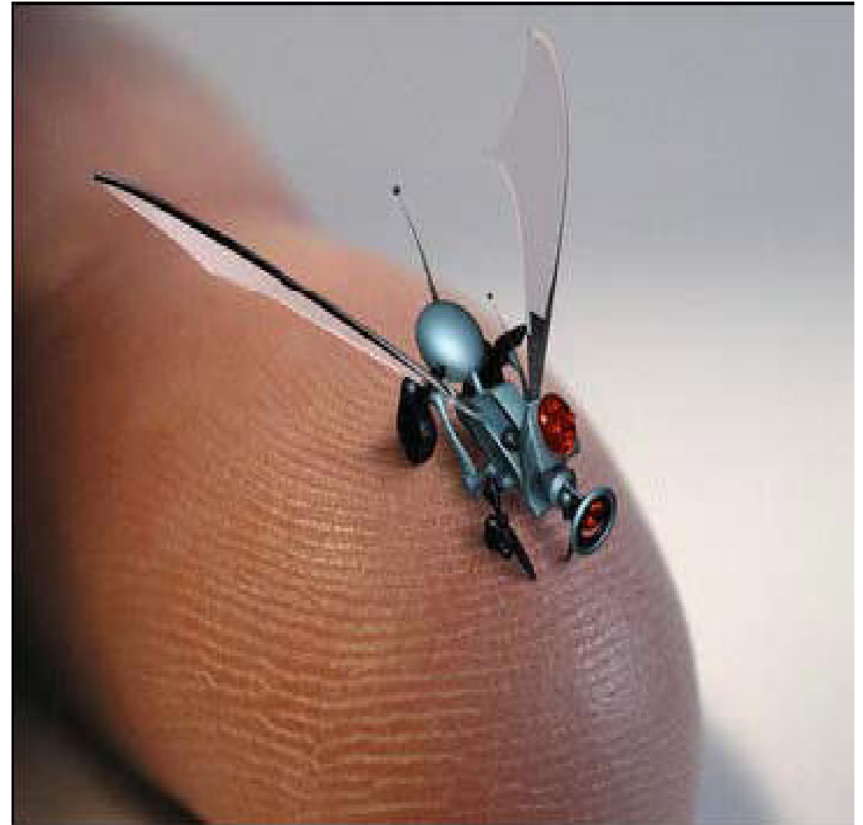
Research and Development

- Increased detection capability such as thermal imagery, automated fire control systems
- Increased muzzle energy from the gun to improve range, accuracy and armor penetration.
- The most mature future gun technology is the electrothermal-chemical gun.
- An electrothermal-chemical gun uses a plasma cartridge to ignite and control the ammunition's propellant, using electrical energy as a catalyst to begin the process.



Bionic Hornet

- Israeli Defense Forces are drawing on the latest breakthroughs in nanotechnology to update their weapons.
- One notable application is known colloquially as the Bionic Hornet.
- No bigger than an average wasp, the flying device is designed to seek out, follow, photograph and even kill selected opponents.
- According to Israel's Deputy Prime Minister Shimon Peres, "It's illogical to send a plane worth \$100 million against a suicidal terrorist."



Nuclear submarines



- A nuclear submarine is a submarine powered by a nuclear reactor.
- The performance advantages of nuclear submarines over "conventional" (typically diesel-electric) submarines are considerable: nuclear propulsion, being completely independent of air, frees the submarine from the need to surface frequently, as is necessary for conventional submarines.
- The large amount of power generated by a nuclear reactor allows nuclear submarines to operate at high speed for long durations.

Armament



- Nuclear submarines carry a wide range of armaments.
 - Cruise Missiles [Agni-II]
 - Ballistic Missiles [Prithvi]
 - Torpedoes [Mark 48 torpedo]
- Serve to intimidate opposition and deliver large fire-power nearly anywhere in the world.

Border Security

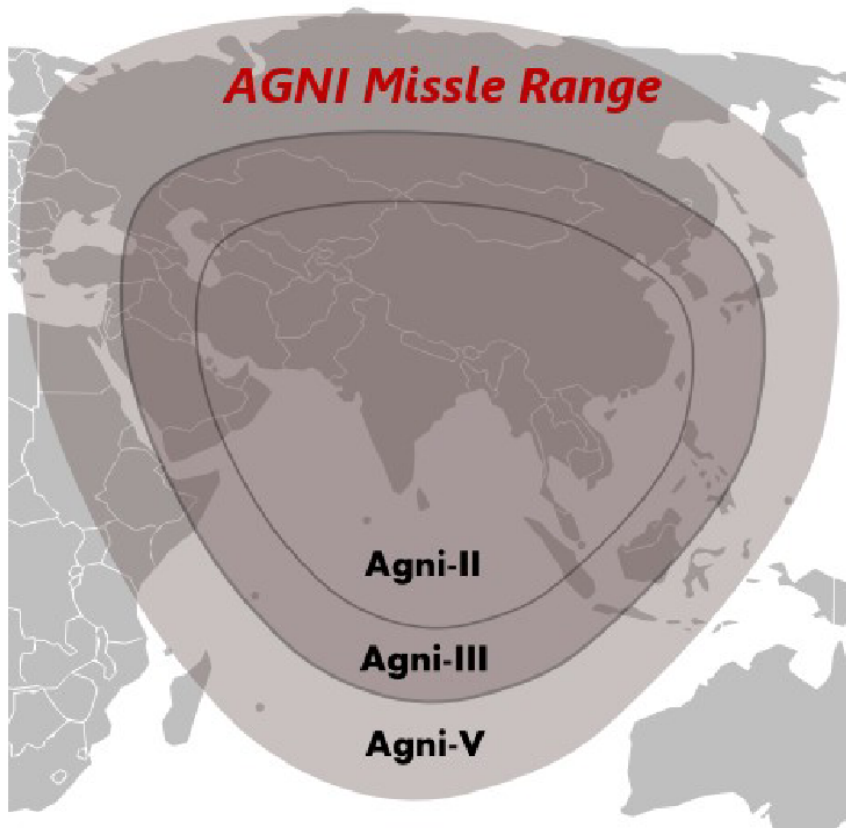
- The nation security mainly involves in the following areas:
 - Land Border Security
 - Waterfront Security
 - Aerial security
- Technology has revolutionized each of these fronts, creating secure and safer international borders.

Land Border Security



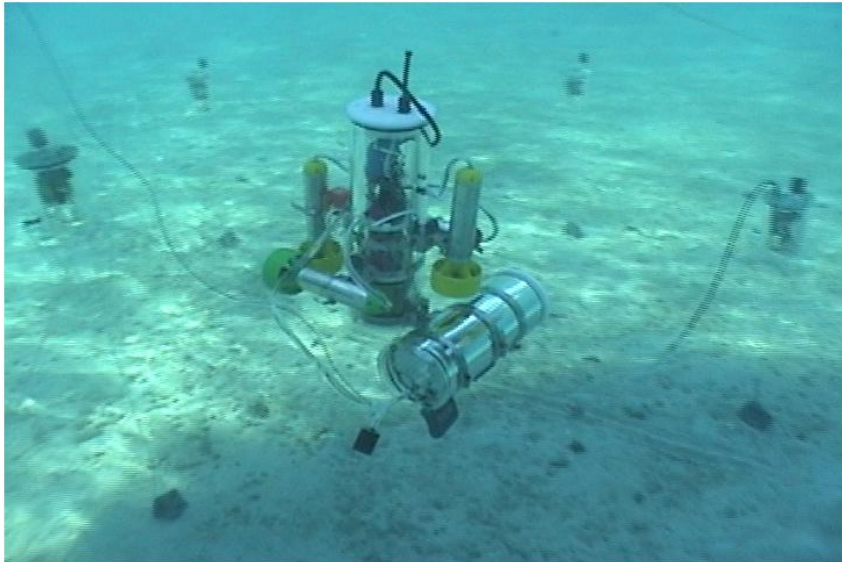
- The most commonly used instrument for land border security is **visual sensor network**.
- It is a network of smart camera devices capable of processing images of a scene from a variety of viewpoints into some form more useful than the individual images.
- The network generally consists of the cameras themselves and possibly one or more *central computers*, where image data from multiple cameras is *further processed*.
- Visual sensor networks are most useful in applications involving area surveillance, tracking, and environmental monitoring.

Aerial security



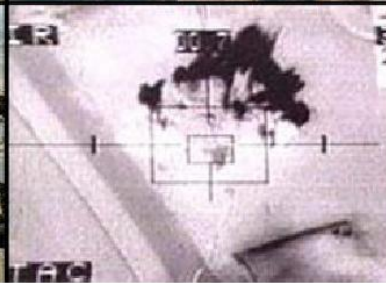
- Missile Defense Program is an initiative to develop and deploy a multi-layered missile defense system to protect nation from missile attacks.
- It is a two tiered system consisting of:
 - **Interceptor missiles** for high altitude interception [Eg. Prithvi Air Defense]
 - **Short range missile** for lower altitude interception. [Advanced Air Defence Missile]
- Such two-tiered shields are able to intercept any incoming missile launched 5,000 kilometers away.

Naval Security



- Underwater sensor networks form the basic shield.
- A towed underwater sensor device comprises of:
 - A towed cable.
 - A fiber optic cable placed within and running the length of said towed cable.
 - Electric circuitry and network device.
- When a disturbance is reported on the sensor cable, the network alerts a computer in the Command center which then can use data from other sensors to gauge the type of threat and effective response.

Smart Missiles and Bombs



- In the early days of aerial combat, the two pilots would pit their machines into long and turning 'dogfights'
- Today a pilot can engage and eliminate OP-FOR even before he can see him. This is called BVR combat.
- The major types of 'Smart Missiles':
 - **Infra-Red:** AIM-8 Sidewinder [*Vietnam*]
 - **Radar:** AGM-88 HARM [*Gulf*]
 - **Laser:** Armement Air-Sol Modulaire (AASM) [*NATO peacekeeping*]
- The main types of guidance system used in 'Smart bombs' are:
 - **GPS:** Joint Direct Attack Munition (JDAM) [*Afghanistan*]
 - **Parameter Sensing:** GB-28 "Bunker-buster" [*Iraq*]

Applications of Mechatronics Engineering in Defence

- Being multidisciplinary mechatronics plays a vital role in defence
 - Ground Defence
 - Aerial Defence
 - Naval Defence

Applications of Mechatronics Engineering in Ground Defence

- Unmanned Ground Vehicles (UGVs)
 - Surveillance
 - Mine Detection
 - Bomb Disposal





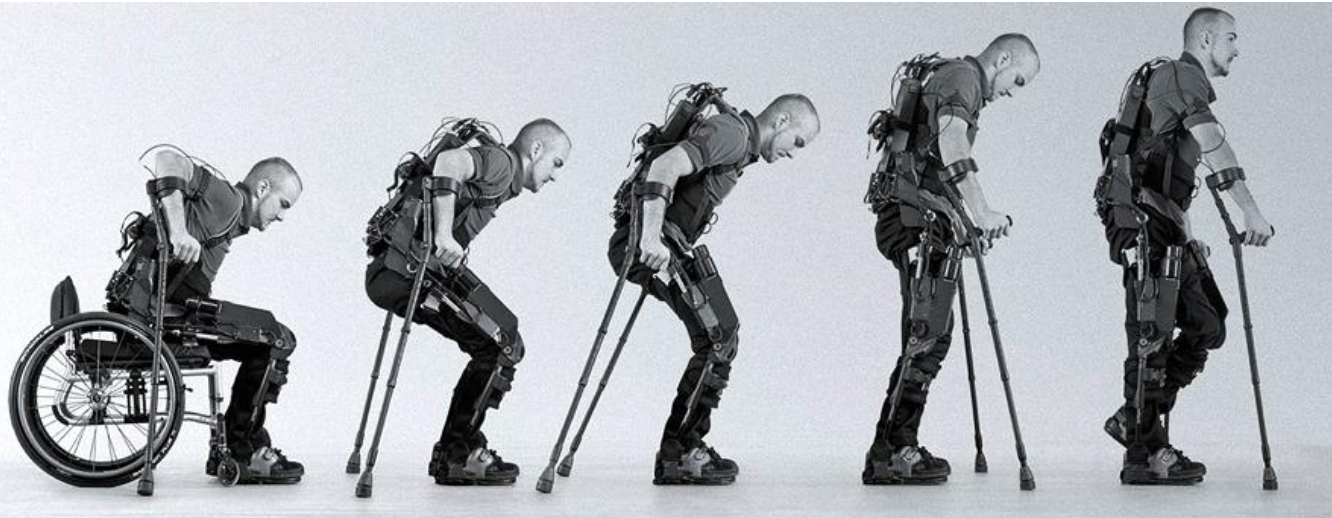
Applications of Mechatronics Engineering in Ground Defence

- Powered Exoskeletons
 - Upper Limb Exoskeletons for carrying heavy equipment at long distances during operations



Applications of Mechatronics Engineering in Ground Defence

- Powered Exoskeletons
 - Lower Limb Exoskeletons for assistance in motion
 - Rehabilitation of Injured Soldiers



Thank You