SAE NITK
SOCIETY OF AUTOMOTIVE ENGINEERS

TECHBUZZ

VOL 3.0 | MARCH 2022

SAE NITK ANNUAL MAGAZINE

DEFENCE AND INTELLIGENCE

#MAKEININDIA

Foreword

I am contented to state that our club SAE-NITK has been one of the most active clubs over the past few years till today and has been doing incredible work. Our institution is very proud of the club.

I would like to take this opportunity to express my gratitude to Prof. Udaykumar R. Yaragatti (Director Incharge - NITK Surathkal), Prof. Narendranath S (Dean Student Welfare) and Prof. Ravikiran Kadoli (HOD - Mechanical Engineering) for their their unending support in conducting our club activities of SAE- NITK .

I am pleased to write this foreword for the 2022 edition of SAE NITK Annual Magazine Vol.3. SAE-NITK has consistently improved the quality of it's articles on the magazine and on weekly blog articles.

I am glad that the SAE - NITK club remains committed to producing an annual college magazine for the most challenging years. This year, the club is bringing out the annual magazine TechBuzz Vol 3.0, which aims to showcase the pride of the nation's defence sector and give the readers a gist of advancements that have been taking place in the Indian Defence sector. I heartily congratulate every member of the club and the editorial team's utmost effort to make this magazine.I thank the convenor Kurma Eshwar Sai Srinivas and the chief editor Likhita J. All the members and coordinators deserve a massive acknowledgement for all the hard work they have been doing to make this club one of the most active clubs in NITK Surathkal.

SAE-NITK has improved in its strength over the years and I hope to see the same in coming years. I firmly believe that our club SAE-NITK will reach several milestones in the years to come. SAE - NITK should continue its great work, and I wish them a huge success in all its undertakings.

Regards
Dr.Poornesh Kumar K
Faculty Advisor
SAE-NITK

Message from the editorial team

We at SAE-NITK are exultant and exuberant to publish the third issue of our annual magazine Techbuzz. As the saying goes: The mind, like a parachute, works best when opened''. This initiative sets the budding minds free, allowing them to roam free in the realm of imagination and make magic out of the term ***''Technology in Defence Sector''***. The ambitious write-ups of our writers are indisputably ample to maintain the curiosity and admiration of the readers. We believe that our success depends upon our endowment to perceive, the capacity to discern and the power to traverse.

'Alone we can do so little; together we can do so much.' - Helen Keller. The above quote is the core of our magazine. Like a team, we all have contributed to developing the articles present within our latest attempt. This strenuous task of editing the magazine would not have been possible without the sincere support of the Media Team members. They painstakingly edited all the articles given and presented them in the best way possible.

'Success consists of going from failure to failure without loss of enthusiasm.'' - Winston Churchill.

Not to forget, we are obliged to our Faculty Advisor, Dr. Poornesh Kumar Koorata, who helped steer our boat from the ocean of instability to the shores of steadfast progress. We are indebted to our Convenor of 2021.22, Mr Eshwar Sai Srinivas, for guiding us throughout the making of the magazine and giving his solid support. We take this opportunity to thank our sponsor Exergic India for helping our club explore new fields and increase its reach. Lastly, we wish all the readers prosperity and pray for their well-being in the era of Covid. We hope they are ever enthusiastic and always endeavour to learn and explore new things with aplomb.

Stay safe, and Keep learning!

SAE NITK editorial team

CONTENTS

Source: img.etimg.com

HISTORY

~ Jishnu Das & Shrivatsa Hegde

The Indian Armed Forces are the Republic of India's military forces. The Indian Army, Navy, and Air Force are the three professional uniformed services that make up the Indian Armed Forces. The Central Armed Police Forces, the Assam Rifles, the Indian Coast Guard, and the Special Frontier Force, as well as various inter-service commands and institutions such as the Strategic Forces Command, the Andaman and Nicobar Command, and the Integrated Defence Staff, support the Indian Armed Forces. The Indian Armed Forces are led by the President of India, who is also the Supreme Commander. The Ministry of Defence (MoD) of the Government of India is in charge of the Indian Armed Forces. With over 1.4 million active personnel, it is the strongest military force. It boasts the world's second-biggest military force and the world's third-biggest military budget.

Threats have increased, border intrusions have become a serious threat and rapid cybercrime activity involvement. The Indian Army has always responded to the change in warfare swiftly and adapted to the new technology and weapons. Indian Armed Forces are poised for major modernization in the next ten years. This process will focus on the upgrading of hardware and systems as well as the latest state-of-the-art equipment. Technology superiority will be the most crucial factor in the near future. Defense Research and development organization (DRDO)-the R&D wing has identified certain key areas for technological developments that would prove to be critical in the coming days.

Defense Research and development organization (DRDO)-the R&D wing has identified certain key areas for technological developments that would prove to be critical in the coming days.

Technologies that strengthen our defence sector:

Nanotechnology and MEMS is one such region. It would bring in lightweight, strong, multifunctional materials for use while enhancing surveillance and connectivity. It would reduce power and weight requirements, increase protection of platforms and durability and thereby enhance the operational effectiveness of platforms. Carbon composites, metal composites, self-healing materials, adaptive camouflage materials, structures, and smart skin materials shall be the main structural materials for future combat and support systems.

Artificial Intelligence and **Robotics** are being extensively used for target identification and classification. Robots can aid in precision targeting and carriage of ammunition. Unmanned vehicles are a direct consequence of miniaturization, which will help design smaller yet efficient vehicles that can even work in groups with other unmanned as well as manned vehicles. Stealth technology has been increasingly used to minimize detection of its own platforms. Along with the use of sensors and radars, it provides a wonderful analysis of all the threats.

All the aircraft in modern times possess night vision and all-weather capability. Depending on the aircraft's role, Auto-pilot modes are being designed to incorporate horizontal & vertical navigation as well as aircraft recovery. **UCAVs** (unmanned combat aerial vehicles) are being increasingly used. In the Naval domain, UUV(unmanned underwater vehicles) and laser communications have gained extreme importance

"Smiling Buddha was the name of India's nuclear program, which was given to RAW to keep it secret."

Growth of Imports & Exports in Indian Defense Sector

– Guhan Sidharth M

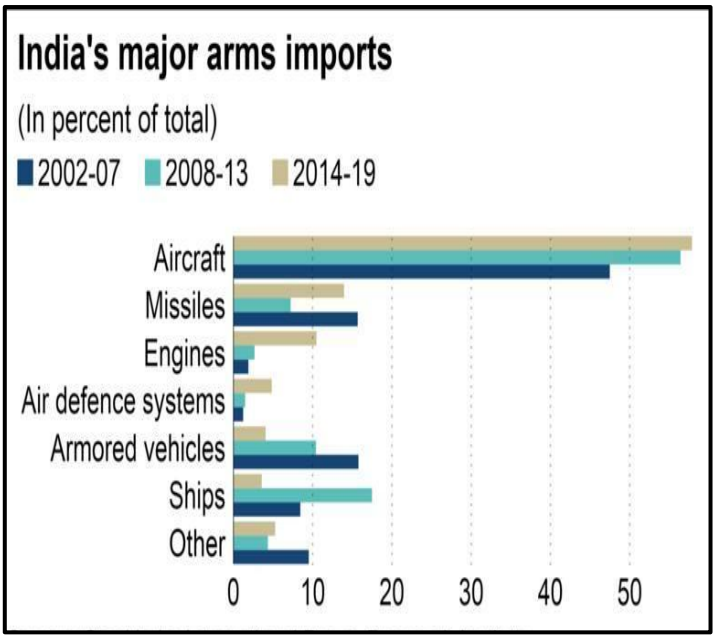
Rafale Jet (imported from France)
Source: liivemint.com

The Indian Military uses state-of-the-art defense equipment which are largely imported from foreign countries. However, the exports scenario is also significantly changing due to various needs and policy measures. Hence it is necessary to analyze the growth of imports and exports over the past few years.

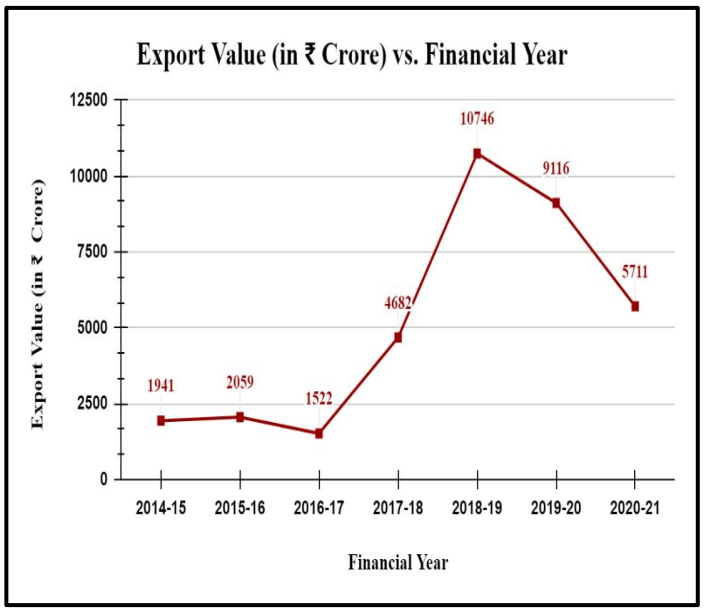
Over the years, Russia has been the largest supplier of military equipment to India. However, India's defense imports fell by 33% between the years 2011-15 and 2016-20. India's top arms suppliers during 2016-2020 were Russia, France and Israel supplying 49%, 18% and 13% respectively of India's arms import. One of the most significant import deals signed by India in recent years is that of the purchase of 36 Rafale jets from a France based company Dassault Aviation, a deal worth ₹59000 crore.

Traditionally, India has not been a very active exporter. However, since the time the NDA government assumed office at The Centre in 2014, the defense exports of India have been steadily growing. According to a statement issued by the Hon'ble Prime Minister of India Shri Narendra Modi in October 2021, India's defense exports grew by a whopping 325% over the last 5 years. In the period 2016-2020, India accounted for 0.2% of the global arms exports as compared to 0.1% during the 2011-15 period. Myanmar, Sri Lanka and Mauritius are the top importers of Indian defense goods.

Effective plans have been put in place to make the Indian defense industry self-reliant, reduce imports and increase exports. Import of defense equipment has been exempted from import and custom duties for a period of 5 years starting from November 2019, which is expected to save around ₹25000 crore. The Indigenous Defence Equipment Exporters Association has been set up with the aim of achieving annual defense exports of ₹35000 crore by 2025. As part of policy, several defense equipment are being prohibited from being imported to enable indigenous development of these equipment.



Trend of Imported Commodities for the Last 20 Years
Source: www.ft.com



Annual Export Value for the Last 7 Years

India is the second largest defense importer behind Saudi Arabia, contributing to 9.2% of the global arms import. India domestically produces only around 45-50% of the defense products it uses, and imports equipment such as aircrafts, missiles, submarines, etc., from countries such as USA, Russia, etc., with these imports contributing to 70% of Indian defense equipment (by monetary value). 12% of worldwide arms exports (by monetary value) are purchased by India. However, things are rapidly changing with increasing focus on “Atmanirbharta”.

> ***According to government sources, India exported defence equipment worth over ₹8,434 crore in 2020-21***

SECRETS OF THE NATION

– Shaik Dilshad Begum
& Pradeep Singh Solanki

Innovation in Defense can only be celebrated if it was a secret till successful, our secrete agencies and departments are continuously upgrading and improving the technological system of India, taking on an advanced system that is already with other countries or which India is capable of, so in this article, we will get an insight about the historical secrete mission and how departments secretly predict a future threat to national security and how secrecy is an internal part of innovation, so let dive into it.

The necessity of maintaining secrets

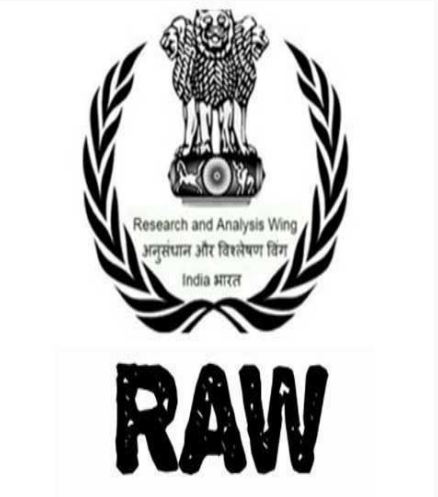
In this competitive environment every country tries to be ahead of others, which calls for the need of latest technologies in defense, infrastructure, ammunition. To do so they research and upgrade their capacities in different sectors. Foreign power tries destroying this research to reduce competition, so every country needs its research to be secret until successful. In the case of spy, they are deployed in different parts of countries to getter intelligence of foreign research, technologies, and plan by becoming one of them.

Secret agencies and officers

All the secret works are handled by secret agencies and agents that operate with false identities in different countries to gather intelligence and predict future attacks on national securities. some of such departments are:

Raw

The Research and Analysis Wing abbreviated (R&AW) is the most important foreign intelligence agency of India. The agency's primary function is to deploy secret officers gettering foreign intelligence, countering terrorism, and helping in planning intelligence attacks on a different country.



RAW (Research and Analysis Wing)
Source: eurasiantimes.com

IB

Apart from RAW who handles foreign intelligence IB works internally within India, They have a strong network of police and special officers. they have the authority to tap any phone call, radio frequencies and have an eye on suspicious email

Ravindra Kaushik was a Research and Analysis Wing (R&AW) operative Famously known as **Black Tiger**, he was an actor in Lucknow and then was picked by RAW to intelligence Pakistan, he has successfully passed information to India and able to occupy officers position in Pakistan army.

Source: theeconomictimes.com

Ajit Kumar Dobhal KC is a current NSA to the Prime Minister and is a central civil servant of the IPS cadre. He previously served as the Director of the IB, after spending a decade as the head of its operation wing. He took part in many secret mission.

Source: navbharattimes.com

Who controls them and who takes the final response?

The challenges of effectively controlling intelligence agencies are high in such an environment where it needs to be independent and secret to people so that it remains away from political involvement. The National Security Advisory of India heads the National Security Council of India, receives all kinds of intelligence reports, and is the chief advisor to the Prime Minister of India over national and international security policy. India's defense, foreign, home, finance ministers, and deputy chairman of NITI Aayog are the members of the National Security Council of India and are liable for shaping strategies for India's security in all aspects.

Intelligence agencies themselves have Directors and senior management can enforce accountability within institutions. Channels for reporting illegal activities, together with a commitment to professional ethics and standards, can contribute to accountability

> ***Scientists worked on the test sites in Pokharan only during the nights so that satellites would be unable to capture clear images due to the absence of light.***

Historical secret missions that were revealed later

DRDO secret missile mission (Project XSV-1)

27 March 2019 was the date when project XSV-1 also known as Shakti was successful. The Microsat-R satellite was successfully intercepted by PDV-MK II interceptor missile designed and developed by Defence Research and Development Organisation (DRDO) was launched from Dr. A.P.J. Abdul Kalam Island.

Pokhran test

In may 1988, India bombed a series of 5 nuclear bomb explosions at the Indian army's Pokhran test range. The objective of these tests was to give India, the capability to build fissions and thermo-nuclear weapons.

Pokhran nuclear test
Source: gstatic.com

How did that prove good

In a country of crores of population with so many rival countries, there is a high chance of misusing the information to cause harm to the security of the nation. Thus, all the top missions are maintained as a secret until it's executed. This helps in a smooth run and the chances of success is very high.

Do we have any laws regarding these?

India's anti-espionage, the official secret act, was introduced in the year 1923. It states that actions involving any kind of help to enemy states in the form of communicating a sketch, plan, model of an official secret, or of official codes or password, to the enemy are strongly condemned.

Source: iasexpress.com

Punishment for violation of laws

Under the act, anyone whose action endangers the state's security will be punished. The punishments range from three years to life imprisonment, depending on the context's depth of secrecy and importance. The official secret act is controversial to the modern RTI act 2005.

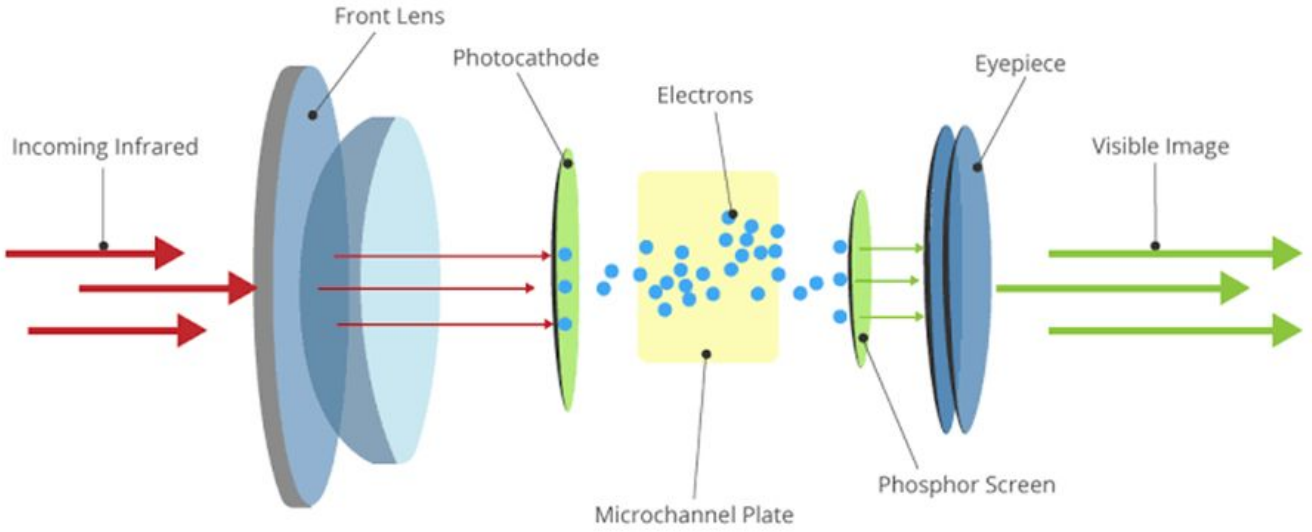
NIGHT VISION TECHNOLOGY

During the night time performing surveillance operations are pretty impossible because humans have poor night-vision compared to many animal species. But now, with the help of proper equipment,we can see a person standing far away in the dark. The research for the technology to see during the nighttime started in the United States in The 1940s. Currently, in the 21st century, we have come a long way in developing night vision technology since its discovery. It is used mainly for defence purposes because it often prohibits its implementation in scientific or civilian ranges.

– Harshal Kawduji Bhoyar &
Lucky Prameeth Rayi

How Night Vision Technology works Night vision works in two very different ways, depending on the technology used.

- Image enhancement: It works by accumulating the tiny amounts of light, including the lower portion of the IR light spectrum, that are present but are inconceivable to our eyes and amplifying it to the extent that we can easily see the image.
- Thermal imaging: This technology works by capturing the upper portion of the infrared light spectrum, in which objects are emitted as heat instead of reflected as light. Warm bodies emit more light than colder objects like trees or buildings.



Working of night vision technology
Source: nightvisiongears.com

Application in Defence

Devices such as night vision scopes and goggles are significant devices used by armed forces. This technology equips all the army planes and complements Stealth technology. Night vision technology gives fighter planes a highly threatening ability during the dark.
Over time, the technology is used for security purposes in various civilian and restricted areas. Also, the aviation sector is using multiple forms of night vision technology for navigation purposes in private and commercial spaces.

View through Army's Night Vision Goggles
Source: gizmodo.com

Tonbo Imaging

Tonbo Imaging is an organization that designs, builds, and deploys advanced imaging and sensor systems to sense, comprehend and control complex environments. It offers a suite of solutions that the critical tactical market needs in military surveillance, infrastructure security, and transportation safety. While most night vision systems run on proprietary operating systems, Tonbo's systems are built on Android. This makes their systems very secure and scalable.

Technologies in Tactics

Tonbo's tactical imaging systems are made for combat missions that meet the requirements of infantry, special forces, and paramilitaries. In support of day-to-day and night-to-day monitoring, tactical systems address the spectrum of observation, precision engagement, and communication. The tactical offerings are modular and interoperable for short-range CQB operations and long-range engagement. Portable systems that transmit digital video are interconnected to battlefield communications networks, making them perfect

Arjun Tonbo Imaging
Source: tonboimaging.com

Tonbo's tactical portfolio provides the future infantry soldier with a range of multi-sensing systems that cover visible, medium, and long-wave infrared spectrums. Coupled with real-time multi-spectral fused imaging and ultra-lightweight target ranging, Tonbo's hand-held and weapon-mounted products provide the dismounted soldier with a wide array of tools for efficient engagement in day or night conditions.

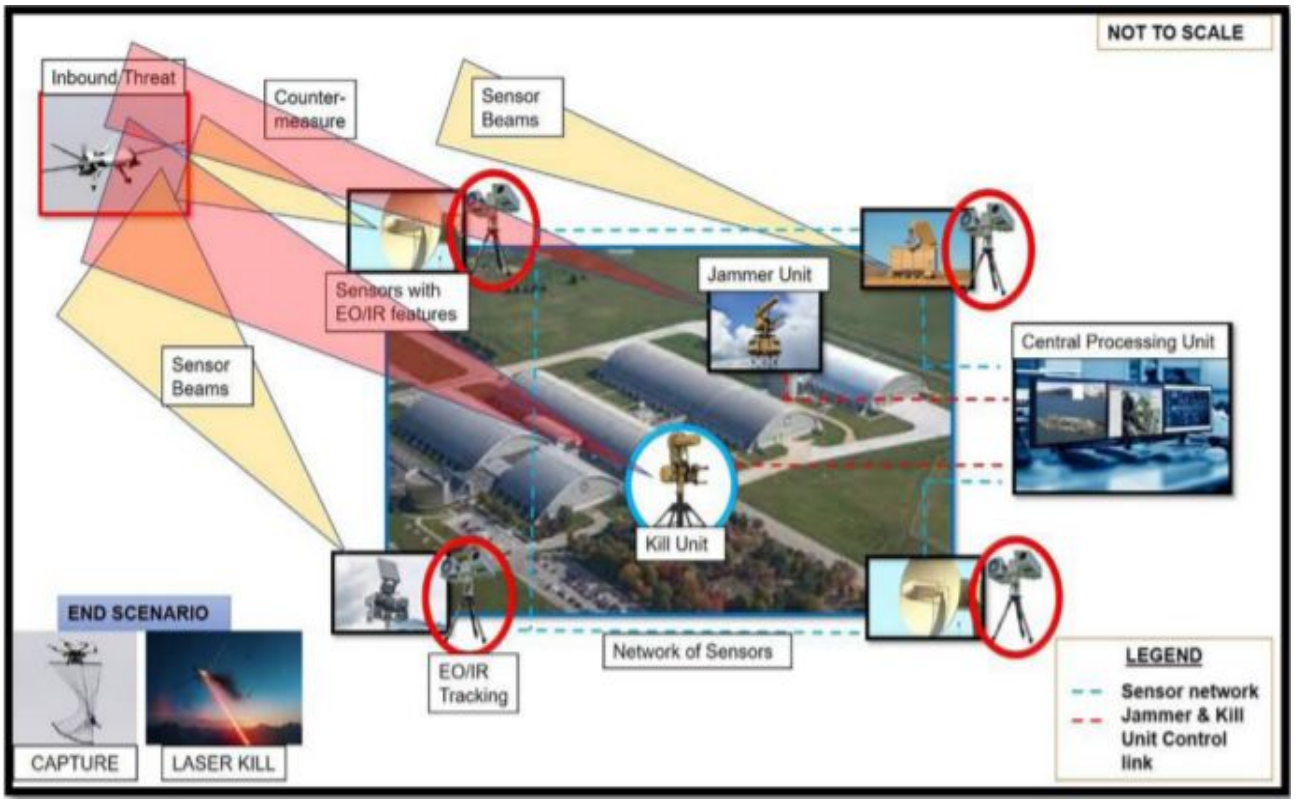
ANTI-DRONE SYSTEM

- Meet Ajay Shah & Mudavath Puja Chawhan

DRDO's anti-drone system *Source: The Economic Times*

On June 27, 2021, an Indian Air Force (IAF) station in Jammu became the first Indian military installation to face a drone terror attack. An unmanned aerial vehicle (UAV) dropped explosives to damage aircrafts. Thankfully, they were unsuccessful in doing any damage to personnel or aircrafts. Subsequently, drones have been seen near Indian army bases and even the Indian high commission in Islamabad, Pakistan. The Indian Army, IAF, and DRDO (Defence Research and Development Organisation) are working together to deploy anti-drone systems for military bases across the Indian borders.

DRDO's anti-drone system is an indigenously developed technology that uses many advanced technologies. DRDO's Chief G Satheesh Reddy has said as quoted, "Counter-drone technology developed by the DRDO will provide the armed forces the capability to swiftly detect, intercept and destroy small drones that pose a security threat". It should be noted that this system has been deployed multiple times on a small scale during events attended by VVIPs like Republic day, Independence day etc., but it is going to be a challenge to deploy it 24*7, 365 days. Let us learn more about anti drone system.



Envisioned Counter Drone System
Source: orfonline.com

Drones are a cheap, readily available and versatile option for our enemies. Small drones become impossible to detect by the RADAR systems deployed right now as they are meant to detect larger aircrafts. So the first significant challenge for the anti-drone system is to detect these small drones. For detecting small drones, a different type of millimetric RADAR systems (integrated with other technologies) are needed, which use lower wavelengths, but the catch is that they have a smaller range also. According to the specifications made public by DRDO, their anti-drone system consists of a radar system with 360-degree surveillance and can detect micro drones within a 20 km range.

It also has an RF detector to detect communication within a 10 km range for those drones that might be piloted remotely.

After detection, the drone needs to be neutralised. For drones piloted remotely, an RF jammer detects frequency used by the controller and jams signals for up to 10 km.

With this, a laser-based system will be deployed to neutralise micro drones within the range of 1 to 2.5 km. The Army has surface to air missiles that can also be used, but each of those missiles cost in lakhs to crores of rupees, while drones like these can be bought online for a few thousand rupees. Sadly, this cost differential favours our enemies, so new methods like lasers are developed to attack these drones.

DRDO has now transferred the technology for production to Bharat Electronics Limited (BEL), a government PSU that manufactures advanced electronics equipment for the armed forces. This technology is an excellent example of India becoming more self-reliant on indigenous technologies. The system has been tested many more times, and deals for the acquisition of the system have been signed between the Indian Army and BEL. So, these systems will be deployed around many military bases, providing a safer environment for the troops in the near future.

DRONE JAMMERS

– ANANNYA RAO &
PATRIKE VEDIKA

Introduction

A drone jammer is a gadget that interferes with a robot's radio frequencies, forestalling the drone pilot from conveying and working. It is a machine figured to send electromagnetic clamour at radio frequencies with the target of overriding a similar radio and GPS flags your robot uses to operate. Drone jammers incorporate compact work areas, bags, folder cases, and vehicle-mounted models for different occupations.

From transporting groceries to high-tech intelligence work, drones are widely used in today's world. With the rapid development of drone technology, just like any other new invention, it also has its dark side. Modern drones have been used to supply illegal goods and have become a significant threat to people's safety. Multiple drone attacks have caused the world to report the news. The only way to solve this problem is to adjust the contour of the drone's movement. This kind of counterattack is called a drone jammer. Due to its continuing threat, drone jammers have been implemented in the defence sector.

Drone Jammers in defence

The drone attack on the Jammu Air Force Station on June 27 served as a harsh wake-up call for India, forcing it to reconsider its choices and strengthen its anti-drone capabilities for unmanned warfare. Now the army is planning to buy several anti-drone equipments that will help identify and jam or spoof the communication and navigation signals of a hostile unmanned aerial vehicle.
Bharat Electronics Limited (BEL) has designed a drone detecting radar that uses frequency modulated continuous wave (FMCW) to identify and monitor mini and micro-class UAVs.

How do they work?

The anti-drone technology that is used to shoot down drones by a physical projectile is none other than drone jamming. Usually, drones use the frequency 2.4 GHz or 5.8 GHz for communication purposes with the ground station. Now, what drone jammers do is, it sends electromagnetic signals of their own of the same frequency, which leads to overriding of the drone's communication system. Most of the time, this results in the drone returning to its home function, which can be used to identify the pilot of that drone.

Portable drone jammers have been used as an alternative for these bulky and heavy jammers, which requires a lot of effort to displace and use surreptitiously.
Drone jamming technology that employs transmitters positioned around the perimeter of the region to be protected from drone penetration is becoming widespread.

Drone Jammer Gun
Source: ytimg.com

> Nowadays,drones are actively used in different domains because of their widespread use. Unfortunately drones are used in spy cameras, and even as weapons. To neutralize these drones to avoid harm, the police and the military are constantly experimenting with different things, from eagles to lasers. Since the security needs have been variable each moment it makes it an absolute necessity for the usage of jammers as a non-conventional technology. India is developing a comprehensive anti-drone strategy to prevent attacks.

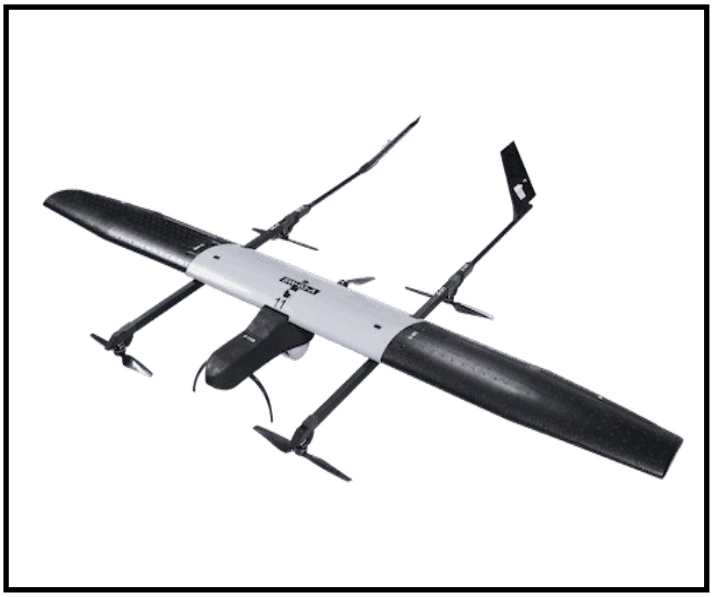
IDEA FORGE

- MS RAGHAV GANESH

Due to a sharp increase in terrorist attacks worldwide, border security has become a top priority in the fight against contemporary national security threats. For instance, the Indian government instituted the Border Security Force to safeguard the nation's international boundaries.

Traditional border surveillance methods include video cameras, ground sensors, land vehicles, and manned airplanes. However, these have proven to be effective but improvisation is necessary . It is necessary to recognize the issues that a country has due to the various border conditions and provide a framework to solve these challenges. Adopting new technology for border control and surveillance is critical to ensuring seamlessness in the authorized flow of persons and things across borders.

Drones are an essential tool in border security because they allow for real-time surveillance, intelligence gathering, target acquisition, and tracking of people and illegal activity via high-quality video feeds. Drones equipped with thermal detection cameras outperform stationary video cameras following irregular activity such as unlawful border crossing attempts over deep woods or mountainous terrain.



SWITCH UAV
Source: ideahub.com

Drones from ideaForge are critical for perimeter surveillance and border security. These drones detect persons and things and aid in detecting border crossing patterns. Drones from ideaForge have become a vital asset for security agencies known for their high real-time intelligence.

India possesses the one world's largest standing army. The country is the world's third-largest military spender. In the fiscal year 2021-22, the government plans to expand this spending even further, to bolster the military's 'modernization.' The employment of UAVs for strategic Intelligence, Surveillance, and Reconnaissance (ISR) requirements is one of the important evolution or transformation milestones.

Drone assisting BSF Source: tosshub.com

The safe and live-feed transmission to any remote receiving device from anywhere in the world is one of the principal advantages of these drones. This implies the Lieutenant General in charge of Northern Command may be up to date on all regional developments in a matter of seconds. Similarly, all essential strategic partners can access the secure (live) feed for effective coordination and coordinated action. The Indian Army has inked a 145 crores ($20 million) contract for an undisclosed quantity of ideaForge's SWITCH UAV's high-altitude variant.

This is a massive step forward in the military's 'modernization' process. With live visual and thermal terrain surveillance, infiltration/exfiltration detection, mission reconnaissance, and real-time counter-intelligence, the Indian Army would gain an advantage.

This agreement is significant for the Indian Army and the country's defense technology industry. There's a lot to take in and notice here. Together with a few other factors, this agreement indicates that the Indian Army's policy is shifting in the right direction.

IdeaForge won this contract against international competition because of a combination of world-class technology and a thorough understanding of customer requirements. With the support of reputable institutional investors, including WRVI, Infosys, and Qualcomm, ideaForge is poised for significant growth.

VINEVLI UNMANNED SYSTEM

– SUMANTH N HEGDE

You may call them flying robots or UAVs; drones are rapidly growing in popularity. From amazon delivery services to covert military operations, these drones are the future of our industry. In India, defense and aerospace are some of the most critical sectors, which account for almost 1.5% of the national gross domestic product. According to a recent report by Maier Vidorno, these sectors are strategically important in India and are expected to reach $70 billion by 2030. However, the report also stated that a considerable portion of the Indian defense needs is fulfilled via imports. As the country strives to become self-reliant or aatmanirbhar, the government has been pushing innovators to develop cutting-edge Made in India technology to empower the defense sector.

Drone equipped with Grenade launcher
Source: liteye.com

Following these ideologies, Gopal Anandayuvaraj, with the help of his friends Eshan Halekote and Yuan Qu, founded a Chennai-based startup named Vinveli Unmanned Systems Inc, which aims to provide infrastructure, communication, and services needed to encourage maintaining a fleet of drones for commercial, defense, and industrial applications. Later on, the startup was also chosen to be a part of the Iowa Startup Accelerator, from where it was launched commercially.

The Make in India initiative, the cost-effectiveness of setting up manufacturing units, and business opportunities are a few of the reasons that brought him back to India. The founder's long-term goal is to integrate technology and enable AI-driven drones to make our lives easier, thus increasing the productivity of people and thus leading to the betterment of society. The startup thoroughly understands the clients' requirements and builds them accordingly. The manufactured drones have helped save lives on the battlefield as they are placed in the front of the commando, taking the first hit while eliminating the enemies.

Vinveli currently has two Indian patents. The raw materials are procured locally, the firing systems and launcher are also entirely manufactured indigenously. The company has designed a drone named Vero, which can carry two 38mm grenades and can be fired mid-air. It also has two cameras which can be used for surveillance and to locate potential targets. Other drone variants are designed to transport food supplies and carry high explosive IEDs.

Today, several people are becoming successful in their respective fields and industries. However, only a handful of them has succeeded in positively impacting people's lives. These entrepreneurs go one step ahead as a revolutionary force in the industry, bringing vast progress to society. Gokul Anandayuvaraj, the founder of Vinveli, is one such tech innovator. He has inspired millions of budding entrepreneurs and engineers worldwide from his consistent hard work. Vinveli Automated Systems Pvt Ltd is helping government organizations in India by equipping them with cutting-edge drone solutions. This startup is envisioned to meet human power and technology to build an intelligent planet. These guiding principles drive the visionaries and technologists at their workplace to work at the cutting edge of defense and aerospace.

Iowa and Chennai-based startup Vinveli is designing indigenous Unmanned Aerial Vehicles (UAVs). The startup was founded by Gokul Anandayuvaraj in 2014, along with his friends Eshan Halekote and Yuan Qu. Vinveli, which counts the Ministry of Home Affairs and Defense as its clients, supplies its drones for combat operations and riot control.

Vinevli Unmanned Systems
Source: vinevli.in

EyeROV

– Khushi Rathod

EyeROV Technologies private limited, India's Underwater Robotics Company, incubated at Makers Village in Kerala. Technological startup cofounded in 2016 by IIT Alumnus Johns T Mathai and Kannappa Palaniappan. EyeROV has built India's first Commercial Underwater Drone, which has applications in Oil Gas, Defence-related fields. EyeROV TUNA is a drone that can capture HD quality images at a depth of up to 300m in the ocean, a non-sophisticated product built by advanced methods of deep learning and conventional Image Processing Techniques, less expensive than the existing ones. It has opted for a B2G kind of Business Model for its operations. EyeROV is unique in applying its team's advanced technology and expertise in providing cost-efficient solutions to address the problems faced in underwater operations.

EyeRov TUNA MINI Source: Deccan Herald

Planys Technologies is India's largest Underwater Robotics startup, striving to provide practical solutions to marine-related issues. Collaboration of Planys and EyeROV to share expertise and resources in their closely related fields can be amazing. A partnership can give each other financial support, the experience of two startups can boost data services.

Pioneers worldwide want data on the topology of oceans to explore and experiment with the oceans. The internationally broad reach of Planys Technologies can provide raw data of various terrains, and the expertise of EyeROV can analyse and process the data efficiently and convert it into the form of visuals and export it to the world and contribute to R&D.

EyeROV Technologies can expand their area of interest and services from inspection to further related and challenging aspects of underwater technology. Switching from the B2B business model to the B2B business model can also boost the company's valuation, which can boost exports.

The tremendous growth of the hardware-based technological startup in less than half a decade is impressive. Story of EyeROV is a needed motivation for the young engineers to utilise their skills to provide real-life solutions

INDIAN AIR FORCE

– Navya Kollipara

Remember when we all hooted at the cool tech introduced in Iron Man. All he does is to call Jarvis to display data on his helmet visor. This dope technology finds high use in the military for critical tasks.

In Military aircraft, the primary mission is to conquer superiority during air combat. The fighter jets require high precision, especially in high-speed manoeuvring and targeting the enemy. The pilot cannot be distracted from looking for the correct coordinates in his cockpit display. With today's advancement in technology, the necessary data for the pilot can now be displayed in front of the pilot's eye, similar to how Iron Man has all his data displayed on his helmet visor.

Head-Up Display(HUD) has become so popular that an ordinary man can purchase it within 100 bucks. HUD is a device that comes with a transparent screen that displays data to users without requiring them to look away from the usual viewpoint. The above advantage proves to be a significant indicator for its usage in the aviation industry. The pilot need not refocus their eyes between the outer view and cockpit display. In aircraft, HUD displays altitude, airspeed, indicators, angle of attack, etc. In military aviation, HUD also includes weapon sensors, firing status and various ways of targeting.

A general HUD consists of a projector unit, a combiner, and a video generation computer.

- Combiner is the transparent angled glass located in front of the viewer onto which the data is projected.
- The Projector unit uses liquid crystal displays to project an image onto the combiner.
- The computer provides an interface between HUD and the systems/data to be displayed.

The employment of HUD's in critical tasks makes the design more significant and complex; Field of view, luminance, compatibility, scaling, eyebox, boresight etc., are some of the important factors.

Unlike fixed HUD, a head-Mounted Display (HMD) is a see-through display projected directly onto the inside of the pilot's helmet visor. The most advanced HMDs continue to get lighter and less bulky to reduce pilots' workload and fatigue while providing pilots with better, more realistic imagery in real-time to maximize their situational awareness and support their missions. Unlike HUDs, found in commercial, corporate, and military aviation, HMDs are used almost exclusively in military aircraft.

The Tejas has a night vision goggles compatible glass cockpit, equipped with a domestically-developed head-up display (HUD), three multi-function displays, two Smart Standby Displays by Central Scientific Instruments Organization (CSIO). Latest model DASH IV is currently integrated in India's HAL Tejas.

Smart Bombs

Ever heard of smart bombs?? Well, yes, bombs can be dumb too.
Conventional unguided bombs, which also go by the name free-fall bombs, gravity bombs, are aircraft-delivered weapons that are not equipped with guidance systems and are simply dropped to follow the ballistic trajectory (projectile motion). Hence the name "dumb bombs".
In warfare, targeting the opposition precisely is a critical task. The use of dumb bombs might not serve the purpose as there is no room for error.

With the advancement in technology, every nation aims to have the best weaponry at its disposal. Smart bombs or Guided Bomb Units(GBU) are the new line of weapons that consist of a guidance system designed to achieve maximum precision and smaller circular error probable(CEP).Compared to unguided missiles, smart bombs are found to be about 100 times effective for hard targets.

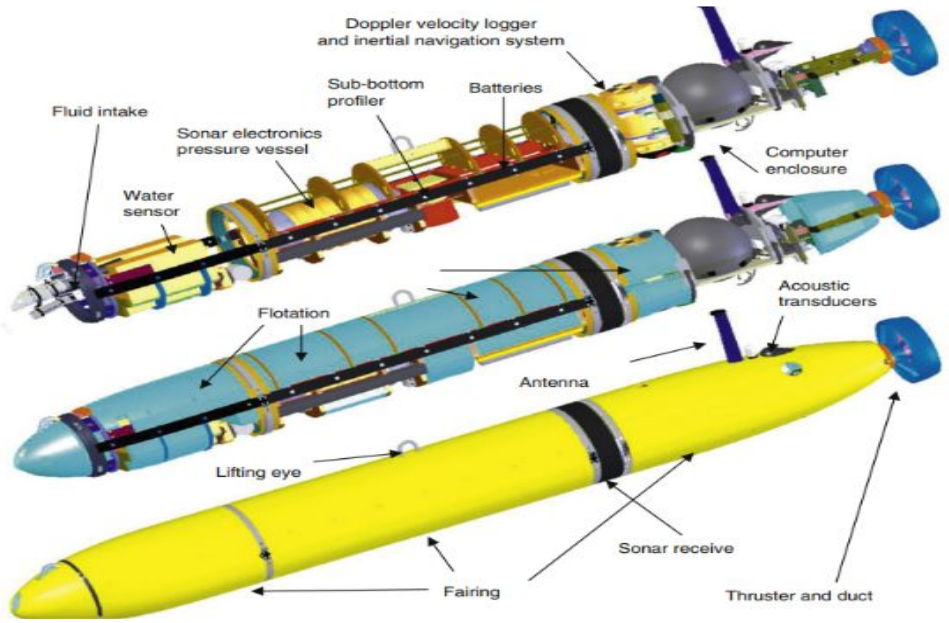
> ***"A Smart Bomb are almost 200 times as effective as a conventional bomb."***

DRDO glide bomb (Gaurav)
Source: bharatrakshak.com

The smart bombs have control surfaces that move in response to the guided commands, and thereby changes are reflected in the angle of descent or direction of fall.
Guidance systems can be infrared, radio, laser or electro-optical, which are generally mounted in the nose of the bomb. The sensors detect the target and adjust the control surfaces. However, bombs of given weight should carry few explosives to accommodate guidance systems.
Currently, in India, DRDO designs the missiles and has come up with successful projects. Sudarshan (India's first laser-guided missile), Gaurav, Gautham, to name a few. The recently tested long-range bomb is capable of hitting ground targets up to a range of 100 kilometres.
From a bow and arrow to missiles that can target about 100 kilometres, we have come a long way. Way more surprising weapons could be seen in the future years considering the drastic evolution and innovation in this industry.

INDIAN NAVY - YASH KUNDALE & SHANOON CARLO

We all must have heard of Unmanned Aerial Vehicles UAVs. Little did we know that Underwater unmanned vehicles called UUVs exist too. With a whopping 7516 km of coastline and some most critical trade routes passing through the Indian ocean, having a robust naval presence in the Indian Ocean waters is crucial for India. India has been pursuing the dream of developing a home-grown UUV.
As the name suggests, underwater unmanned vehicles are unmanned and are used to increase the reach of the Navy while keeping sailors out of harm.



Modular AUV with labelled subsystems Source: researchgate.net

Autonomous Unmanned Vehicles

AUVs are computer-controlled vehicles deployed from a surface vessel primarily for exploration, oceanography, and accessing inaccessible regions. AUVs carry a variety of equipment for sampling and surveying, such as cameras, sonar, and depth sensors.
Depending on the purpose of use, AUVs can range from a few hundred to several thousand pounds. Low cost and an extensive range of operation are significant advantages of AUVs over tethered vehicles.
Torpedo-like vehicles are the most common class of AUVs. They are used when speed or efficient motion is of primary concern. Gliders are a type of AUVs that utilize their ability to control buoyancy to generate vertical motion. These vehicles can operate at lower speeds and use high-energy-density batteries for several months. They follow a sawtooth path across the sea depth and transmit the data collected to the surface vessel or even satellites.

Remotely Operated Vehicles

A Remotely Operated Vehicle (ROV) is a tethered underwater robot. They are unoccupied and highly manoeuvrable. They are operated by a crew, either on a ship or on land.

They are linked to a host ship by a neutrally buoyant tether or an umbilical cable with TMS(tether management system). This is used in rough conditions or deeper water.

TMS automatically lengthens and shortens the tether, minimizing the cable drag. The umbilical cable contains electrical conductors and fibre optics. They carry electric power, video, and data signals and distribute them between the components.

Most of the power drives a high-power electric motor and a hydraulic pump.
The pump provides power to torque tools and manipulator's arms.
Most ROVs have a video camera, lights, sonars, magnetometers, a manipulator or cutting arm, water samplers, instruments that measure water clarity, water temperature, density, sound velocity, light penetration, and temperature.

Primary applications in the Navy include disarming an explosive and detection of enemy submarines. ROVs have an extended underwater submerged capability. They can exert a strong force to manipulate an object. With specialized payloads, they are used in Submarine rescue missions.

UUV developed by CMERI Durgapur West Bengal
Source: cmeri.res.in

India's Efforts In UUV

Defence Research and Development Organisation (DRDO) has developed a flat-fish UUV. It can travel at 7kms/hr and operate at 300mts depth. It is pre-programmed with algorithms and mission requirements. The Indian Navy is currently using 10 of this UUV.

- The Naval Science and Technology Laboratory (NSTL) in Visakhapatnam has indigenously developed AUV.
- India has the 'Samudra', a low-cost AUV that operates underwater. It can undertake path detection, obstacle avoidance and target identification under the sea.
- The Adamya AUV is made by L&T. It can operate for more than eight hours at 4 knots and can dive up to 1500 ft.

The Indian Navy is acquiring High Endurance Unmanned Underwater vehicles mainly for Intelligence, Surveillance, and Reconnaissance (ISR), Anti-Submarine Warfare (ASW), and Mine-Counter Measures (MCM) duties.

RADAR AND SONAR

– Manoj G S & Dayananda B N

RADARS

Basic foundation of radar was found in the early 1880's by Heinrich Hertz, but it came into light during World War II. The RADAR (Radio detection and ranging) system uses radio waves to determine an object's velocity, range, and angle. Radar systems have been employed in military applications for land surveillance, weapon control, fire control, air traffic control (ATC), moving target indication (MTI), weapons positioning, and vehicle search, as well as to identify aircraft, ships, battleships, weather formations, and remote terrain. In general, a RADAR system consists of a transmitter that generates an electromagnetic signal that is then sent into space by an antenna. This signal is reflected or reradiated in various directions when it strikes an object. The radar antenna receives the reflected signal and sends it to the receiver, which is processed to identify the object's geographical data.

RADARs in India

Radar development in India is spearheaded by the Electronics and Radar Development Establishment (LRDE), which is part of the Defence Research and Development Organisation (DRDO). Various radar systems created by this organization have been integrated into the Indian Armed Forces in substantial numbers. For the production of radars, LRDE collaborates with Bharat Electronics Limited and private companies such as Astra Micro and Data Patterns.

Indigenously developed ROHINI RADAR at Republic day Parade 2018

SONARs

SONAR (sound navigation and ranging) is a technology that uses ultrasonic waves to assess and quantify the distance, direction, and speed of objects underwater. Sonar is suitable for examining and studying the ocean since sound waves travel farther in the water than radar and light waves. Active sonar transmits sound waves into the water. If it encounters an object, the signal is bounced back and reverts an echo to the sonar transducer. In contrast, passive sonar can only listen to the signals that travel towards it and cannot emit their own signals. Submarines employ SONAR to communicate, and military ships use it to detect underwater torpedoes and missile strikes during wars.

Sonar in India (USHUS)

The Naval Physical and Oceanographic Laboratory (NPOL), which is part of the Defence Research and Development Organisation (DRDO), developed the USHUS integrated sonar system for use in Indian Navy submarines. Naval Physical & Oceanographic Laboratory (NPOL), a DRDO laboratory situated in Kochi, designed and developed the sonar USHUS systems.

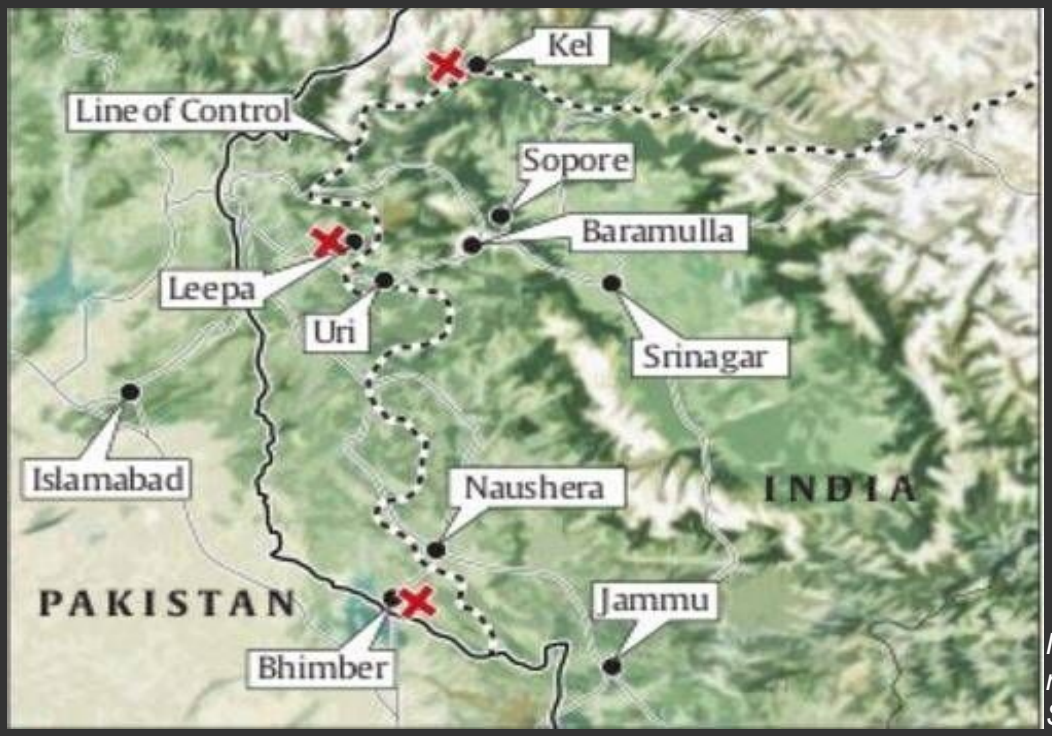
USHUS Submarine suite model on display at Defence Expo 2018

USHUS can be used for underwater communication and obstacle avoidance and detecting and monitoring enemy submarines, surface vessels, and torpedoes. The sonar can operate in both active and passive modes, and it can intercept and communicate underwater. It's deployed in Sindhughosh-class submarines as well as Arihant-class nuclear-powered ballistic missile submarines. The USHUS-2 integrated submarine sonar suite is a state-of-the-art upgrade to existing USHUS sonars.

USHUS-2 is primarily a combination of passive and active detection sensors that aggregate various properties of a particular target and provide information for engaging the target. Passive and active sonar, intercept sonar, collision avoidance sonar, and deep ocean telecommunication are among the sonars that constitute the suite. Sophisticated monitoring techniques and cutting-edge hardware platforms are used in the sonar suite. Advanced categorization characteristics, interface motion analysis, and automatic missile detection are all included in the system.

Role of Intelligence in National Security

– SHIVASTHAN D & LAKSHMI
AASHISH PRATEEK J



Map depicting major hotspots near line of control
Source: The Indian Express

Intelligence plays an important role in ensuring a country's peace and harmony. Intelligence Bureau (IB) and Research and Analysis Wing (R&AW) are India's domestic security and counter intelligence agency under the Ministry of Home affairs. IB is assigned the role of internal security, domestic intelligence and to execute counter terrorism tasks whereas R&AW was specifically formed to gather foriegn intelligence.

"URI attack", considered to be the one of most fatal attacks carried out by terrorists in the past two decades was no surprise for Indian security forces. IB alerted the security forces in the state regarding potential terrorists infiltration in Uri sector well in advance. Following this input, on 15th November, three days prior to the terrorist attack, Intelligence Bureau issued a detailed alert about **Fidayeen attack** (Suicide attack) on the Indian army camps. According to intelligence, three Fidayeen squads were deployed from Pakistan. On 18th November, four terrorists infiltrated Indian Army brigade in Uri by breaching firstly through Line of control(LOC) and then through properly maned wire fencing around the camp. 17 army personnel lost their lives and additional 19-30 soldiers were reportedly injured during the attack. All four militants were killed in instant retaliation. Another squad was encountered by army and police in the Poonch area. Third squad was suspected to be along Srinagar highway targeting BSF and CRPF convoys, but it was not traceable.

The Pulwama attack was one of India's biggest threats faced in the past few decades. The pulwama attack occurred on 14th feb 2019 when a convoy of vehicles carrying Indian security personnel on the Jammu–Srinagar National Highway was attacked by a vehicle-borne suicide bomber at Lethapora in the Pulwama district of the erstwhile state of Jammu and Kashmir. The result of this attack impacted 40 men who were police reserve force as they lost their lives as a result of this suicide bombing. The responsibility for the attack was claimed by the Pakistan based Islamist terrorist group, Jaish e Mohammed.

Source: BBC

India's Retaliation

Intelligence received prior to attack: 8 days prior to the attack on february 8th 2019 the Jammu kashmir police had received intel which was found on twitter, but not just any twitter handle, it was found on the 313_get handle which was not a public handle, and it contained a video along with a caption "InshaAllah...its will same in Kashmir...."; and a 33 second video of troops in Somalia being attacked by the militants in a similar fashion as was replicated on thursday in the attack on

I**ndia's Retaliatio**n: Later on 26 February 2019, India confirmed the airstrike, stating that the Indian Air Force conducted them in retaliation to the Pulwama.

Attack. The strikes were subsequently claimed to be "non-military" and "preemptive" in nature; targeting a Jaish e Mohammed facility within Pakistan. After releasing the bombs, the jets returned into Indian airspace unharmed and the Indian media claimed that whilst Pakistan scrambled its F-16 jets, they could not engage the Indian planes. Air Marshal Masood Akhtar part of the Pakistan retired Air marshals, opined that the air forces of both countries. may have been instructed not to attack each other to better the situation and prevent further escalation.

INTERNATIONAL RELATIONS

– Mayur Belle &
Shanu P S

Lincoln defines International Politics as “the interaction of individual nation-states in the pursuit of their perceived national interests and goals.”

The Ministry of External Affairs (MEA India), also known as the Foreign Ministry, is the government agency in charge of India’;s international affairs, maintaining diplomatic relations with 201 countries worldwide. Which also helps India gain worldwide clout and an influential voice in global issues.

India - US Relations

The defense cooperation has been a critical element of India and USA friendship as this has both strategic and economic shared interests, based on the democratic ideology of both countries. And for the most part, recent successes have positioned the partnership for today, and it must evolve and grow to prepare for tomorrow’s challenges.

Source: businessstandard.com

Also, India has signed the Logistics Exchange Memorandum of Agreement (LEMOA), Communications Compatibility and Security Agreement (COMCASA), Industrial Security Annex, and the Basic Exchange and Cooperation Agreement (BECA) to facilitate military to military cooperation.

The defense minister Manohar Parrikar and US defense secretary Ashton Carter said the pact will facilitate opportunities for “practical engagement and exchange” while signing the LEMOA.

USA was the first country that sent his ambassador to Inida.

India - Russia Defense Relationship

Indo-Russian relations foreign policy are the bilateral relations between India and Russia. During the cold war, India and the Soviet Union (USSR) had a strong military, economic and diplomatic relationship. And the cooperation between two countries is not limited to a buyer-seller relationship but includes joint research and development, training, service to service contacts, including joint exercises. India's defense ties with the Soviet Union and Russia were significant bilateral ties. However, there has been a deep strain in the relationship recently. Recent defense deals have conveyed a clear message that New Delhi considers relations with Moscow to be an essential part of India';s foreign policy. Russia agreed with India to strengthen the defense partnership with the "Make in India" program.

Source: brightspotcdn.com

Recently on 6th December 2021, Defence Minister Rajnath Singh and his Russian counterpart Gen Sergey Shoigu signed an agreement for joint production of over six lakh AK-203 assault rifles at a manufacturing facility in Uttar Pradesh's Amethi.

Counterterrorism

Counterterrorism is another realm where both countries find a common interest. Both countries strongly condemned terrorism in all of its forms, emphasizing the importance of a coordinated global response to the terrorist threat.

They also demanded that all terrorist "safe havens," presumably referring to Pakistan, be eradicated once and for all. India and Russia are likewise concerned about the deterioration of Afghanistan's security situation, notably along its borders.

India openly expressed Russia's concerns about the situation in Syria. India's stance on Syria will indeed contribute to strengthening its ties with Russia, dispelling the perception that India was not willing to back Russia in difficult times.

OUR ROLE / INFLUENCE AT UN

– DIVYAM VERMA & NISHCHAYI V

The United Nations (UN) is an organisation that helps the world maintain peace and good relations. UN is the most familiar international organisation. UN has its headquarters in New York City and other central offices in Geneva, Nairobi, Vienna, and The Hague.

UN's primary purpose is to maintain peace. UN sends peacekeeping troops to places that are conflicted. These peacekeeping forces are not owned by the UN but sent from the countries voluntarily to maintain peace. Since 1947 UN carried out 71 peacekeeping operations. UN believes that to prevent human suffering and economic loss after conflicts. The ultimate solution is to prevent disputes from happening first, so the UN has its ways of maintaining peace.

Peacekeeping operations get their mandates from the UN security council and are managed by the Department of peace operations and supported by the Department of operational support.UN's one other purpose is to protect human rights. The United Nations

Commission on Human Rights was formed in 1993 to look at human rights issues for the UN. UN also has bodies responsible for protecting women and children rights like the United Nations Commission on status of women the United Nations Development Fund for Women. UN started maintaining peace with its security troops in 1948 when the security council authorised the UN military to look after the Armistice Agreement between Israel and its Arab neighbours,

Few works that the UN does to maintain peace between nations are:

- Protect common people and the personnel of the UN.
- During times like elections, the UN provides protection.
- They help in the country's military building and personnel.
- They look after the areas in which conflict has happened, provide security, and monitor peacemaking processes.
- Monitoring disputed or dispute-prone borders.

United Nations General Assembly
Source : history.com

The United Nations Office of Military Affairs generally takes highly qualified military officers from UN member states for peace missions worldwide. In 2019 there were 4.7% of UN military personnel were women. One of the top priorities of UN peacekeeping is to have more female military personnel in their peacekeeping operations and even in women staff officers number to 25% by the year 2028. As of now, there are 16.7% of women staff officers and military observers in peacekeeping operations of the UN.

Although the UN is trying and making peacekeeping operations UN doesn't have a standing reserve. For the UN to deploy military personnel, they should first get authorised by UN Security Council. The Security Council decides the number of troops that must be sent, and the UN liaises with member states and deploys the personnel. This takes so much time. Sometimes even six months from the day of resolution might happen. Having thousands of military all the time isn't easy it

Maintaining that large force every day would cost a lot, so there isn't a standing reserve force for the UN.

> *More than 2 lakh Indian's have served 49 out of 79 peacekeeping missions conducted by the United Nations over the past 70 years.*

How it strengthens our Defense unit?

- Yogesh P

Defence cooperation operations have played a vital role in enhancing India's ties and developing 'Bridges of Friendship' with countries in its neighbourhood as well as key global powers through fostering mutual trust and understanding.

Exposure to technology, organisations, doctrines, concepts, and skills, including Special Forces culture and working ethos of countries with a wide range of technology, sharing combat experience, such as through interaction with US CENTCOM experienced military leaders, and peacekeeping experience, particularly of NATO countries, are all important areas that allow for the capacity enhancement of own armed forces.

Additional benefits include changing the engaged militaries' mutual perceptions, building mutual trust, the opportunity to cross-train on foreign militaries' weapons, equipment, and communication systems, intelligence sharing at military intelligence levels, and enriching the armed 54 forces cadre by broadening their horizons. It has also aided in the formation of a group of officers from all three services who are sufficiently knowledgeable with foreign militaries' war and staff procedures in many domains of engagement.

Military-technical cooperation

It includes the provision of armaments and equipment to partner countries, as well as access to technologies and investments, is critical in inter-state relations. Military-technical cooperation, which includes providing partner countries with armaments and military equipment, access to technologies, and investments in the defence sector, is becoming increasingly essential in inter-state relations.

Source: Indian Navy ALH (Advanced Light Helicopters) LHS 2, Shrey Chopra

The security and commercial aspects of defence equipment export and import are intertwined. With the introduction of a large-scale Sukhoi licence production programme, under which HAL intended to build 140 Su-30MKIs in India, the scope of cooperation with Russia has grown. Six Lockheed Martin C130J Super Hercules aircraft, for which an agreement to purchase was signed in January 2008; eight long-range maritime reconnaissance aircraft; and an amphibious transport ship, the USS Trenton, from the US have all been made possible thanks to the defence cooperation agreement.

Ecuador has signed a $56.7 million contract for seven 'Dhruv Advanced Light Helicopters.' In addition, the DRDO and Embraer, a Brazilian company, struck an agreement to jointly develop an Early Warning System (EWS) for the IAF. India may be able to grow its defence exports, particularly in the near and extended neighbourhood, if it privatises its defence industry and begins to coproduce advanced weapons systems with its partners. This would bring more financial benefits to the country.

Support for Joint Research and Development Projects

We will continue to suffer from a lack of modern and cutting-edge technologies due to our terribly inadequate R&D base. To this end, we must establish meaningful bilateral relations with industrialised countries, particularly the ASEAN area, Japan, and South Korea, which are fairly apolitical. As a result, we can not only duplicate our technological imports from the West, but also build a future indigenous R&D infrastructure. Research and technology opportunities have also improved as a result of defence collaboration initiatives.

Cyber Security & Data Integrity

What is cyber security and data integrity?

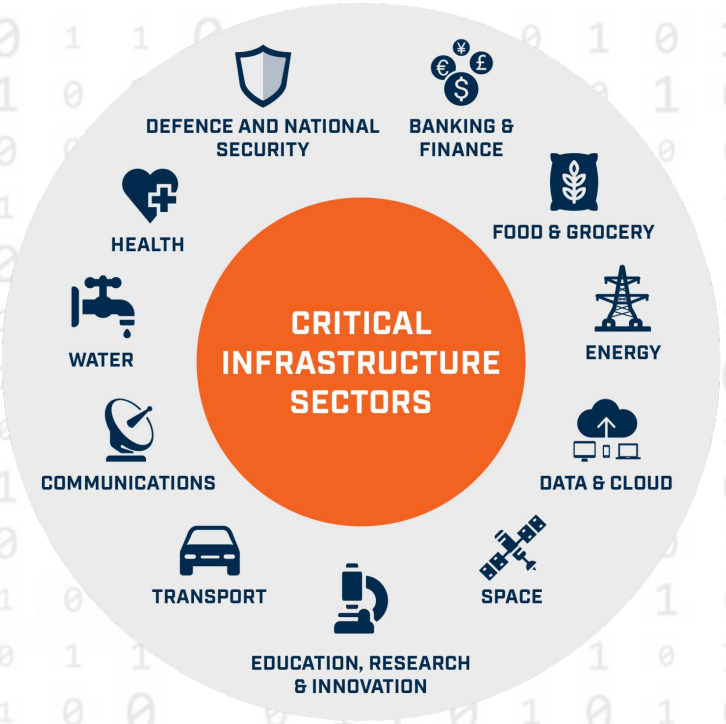
Data integrity is maintenance and assurance of the accuracy and consistency of data. Information should be unaltered, ensures safe communication, safe storage, auditing.
Cyber Security refers to defending computers and other electronic devices against cyber threats so that no cyber crimes take place and also analyzing previous cyber attacks and patching up the vulnerabilities. As ensures security, also maintains data integrity as no unauthorized person can change/alter, damage data and place malicious data in databases through attacks.

Why cyber security?

There is an increase in usage of the internet in recent days, and there is also a rapid growth in development of Information Technology, with which there are a wide variety of applications which are commercialized in social, economic and communications platforms. Along with the development, people started using devices like smartphones, laptops to connect with other people and other e-commerce uses. With this we can say there is a positive growth, but along with that there is a development in spread of malice content. With vulnerabilities, threats found in applications which can be misused, there is a huge risk in using those applications. With this stability of the system, data-integrity is compromised, so that's the reason why there is a need for security.

- Prasanthi Bolimera,Shashiprakash, Sai Srujan

- The Cyber threats are in types as follows: malware, SQL injection, phishing, Man-In-the-Middle attack, Denial-of-service attack.
    - **Malware** is software which is created by a hacker to damage a user's computer, mostly is sent by email where the user might download it and malware enters the user's computer. Different type of malware exists such as Virus, Trojan, Ransomware, Spyware, Adware, Botnets. These different types of malware is used by a hacker/ cybercriminal to commit a cyber-crime.
    - **Phishing**, users are targeted then receive emails (seem to be legitimate but not) and are asked to send crucial personal information.



Areas where Cybersecurity is required
Source: Financial Express

    - **SQL (Structured Query Language) injection**, it is used against the vulnerabilities of a database , is executed by inserting a malicious code into the application's database by inserting a malicious SQL statement.
    - **Man-In-the-Middle attack**, the hacker intercept the connection between an authorized user and the server then access/steal data by impersonating the authorized user.
    - **Denial of Service attack**, here the servers/systems are sent requests in a high number then increase the traffic to incapacitate the system , preventing the system from executing vital functions.

With India having high population which may lead to high internet users also results in large data which is at risk and according to statistics, our country stands in top 10 countries with the most mobile phones affected by malware and an average of 788 bot-infected computers per day. With these kinds of attacks, in the year 2019 there was a loss of ₹ 1.25 trillion in India..

Measures taken by Indian government to tackle cyber attacks

Information Technology Act (IT), 2000

It is the primary law for dealing with cybercrime and digital commerce in India.

- The act covers a broad range of offences including child pornography, cyber terrorism etc.
- **Section 75** of the Act empowers the government to punish people located outside India who is accused of the offense.

National Cyber Security Policy, 2013

The policy establishes a vision and strategic direction for safeguarding the nation's cyberspace. The following are some of the policy's goals:

- The policy's goal is to direct the behaviour of stakeholders (users) in order to ensure cyberspace security.
- To create a secure and resilient cyber-ecosystem with adequate trust and confidence in electronic transactions
- Strengthen the regulatory framework in India for ensuring secure cyber ecosystem.
- To develop suitable indigenous technologies for the ICT sector.

National Critical Information Infrastructure Protection Centre (NCIIPC):

- The NCIIPC was established by Section 70A of the IT Act.
- In terms of vital information infrastructure protection, it has been classified as a national nodal agency.
- Its goal is to secure and protect critical information infrastructure (CII) from cyberterrorism, cyberwarfare, and other threats.

National Cyber Security Coordination Centre (NCCC)

Threats must be assessed in real time by the NCCC. Furthermore, they improve situational awareness of potential government cyber threats. It began operational in 2017.

Cyber Swachhta Kendra: It is a platform that allows users to evaluate and clean their computers by eradicating viruses, bots/spyware, Trojans, and other malware. It was first released in 2017.

Cyber Surakshit Bharat Initiative: In 2018, the Cyber Surakshit Bharat Initiative was established. The goal of the programme is **to raise awareness about cybercrime**. Capacity building for Chief Information Security Officers (CISOs) and frontline IT personnel across all government agencies is also a focus of the effort.

Sandes Platform:

- It's a similar-to-WhatsApp instant messaging platform. Previously, it was known as the Government Instant Messaging System (GIMS).
- Anyone having a phone number or an email address can utilise the platform for any type of communication. Users will be able to communicate in a secure manner thanks to the platform.
- It was first introduced in 2020 for State and Central government employees, but it has recently been expanded to include all citizens.All new apps are audited before being hosted, as well as at regular intervals afterward.

Cyber Surakshit Bharat Initiative
Source: sarkariyojna.com

Challenges in tackling cyber offenses

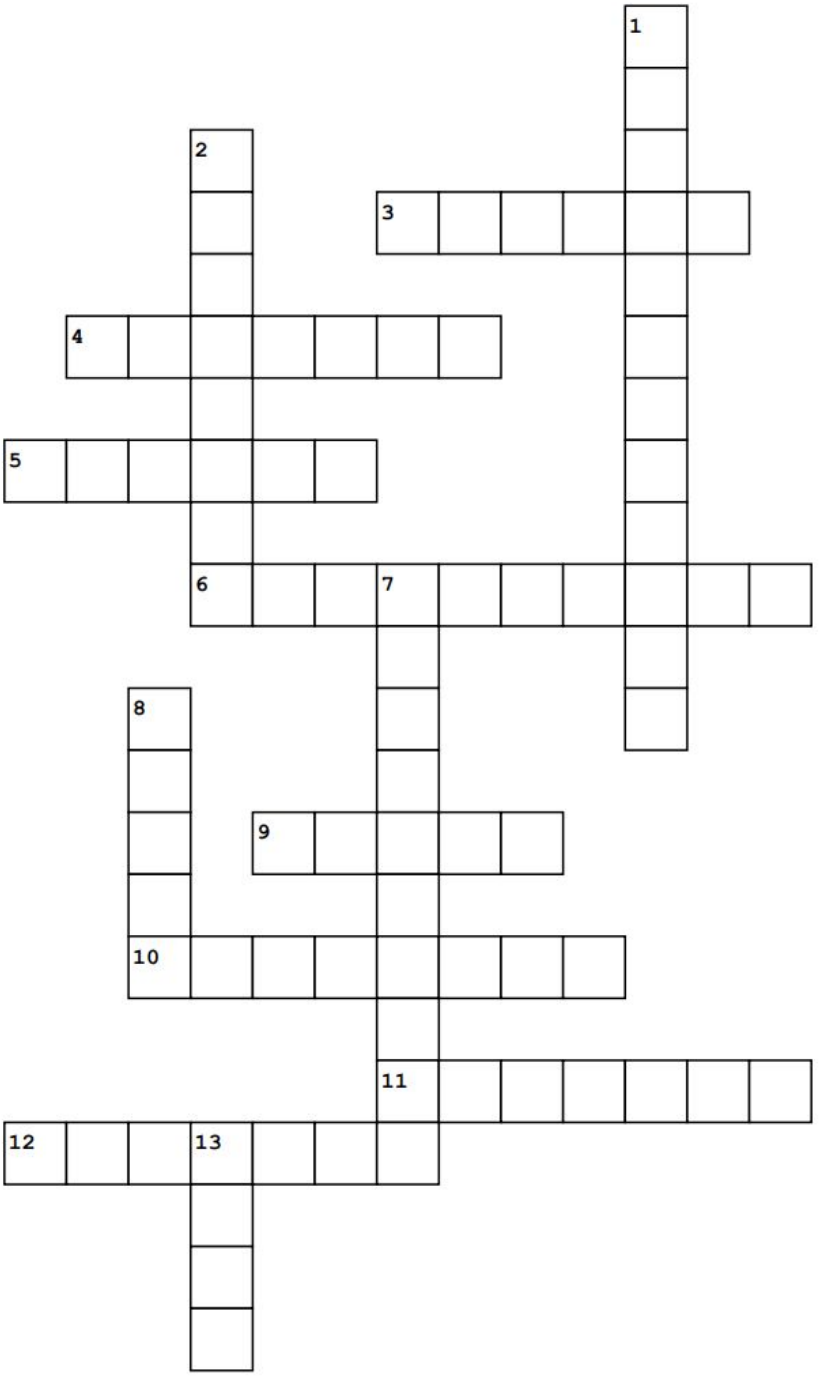
- **Poor cyber security infrastructure**: Extremely few cities in India have cyber crime cells and the establishment of dedicated cyber courts is also very uncommon in India.
- **Awareness issue:** People do not report cyber crimes for a variety of reasons, including a lack of awareness or a fear of harassment.
- There are many **data-related problems** in ensuring cyber security. Such as, the vast majority of Indian data is housed in data centres outside the country. As a result, data storage businesses do not inform India about cyberattacks; and the incentives for cybercriminals have increased as online transactions have grown. An example of this is a recent cyberattack on Zomato (a food delivery app) .
- **Capacity deficit of officials:** Law enforcement agencies tasked with conducting cyber investigations frequently lack the necessary cyber capabilities and training.
- **Anonymity:** Individuals can use encryption techniques to hide or misrepresent their profiles in cyberspace. This increases the difficulty of the investigation.
- **Jurisdictional concern**: In cybercrime, a person can commit a crime while sitting in a remote place anywhere on the planet. A classic example of this is the recent Wannacry virus attack. Even if the perpetrator is discovered, bringing him to justice and conducting a trial in court will require international collaboration.

As the defense sector stores and processes a large amount of confidential information on computers, network outages, computer viruses, data conceded by hackers, and other incidents affect our lives in ways that range from inconvenient to life-threatening. As a result, with the growing number and sophistication of cyber attacks, there is a greater need to defend personal information and sensitive business, as well as national security.

- Wilson, Adithya M S, Samyak Jain

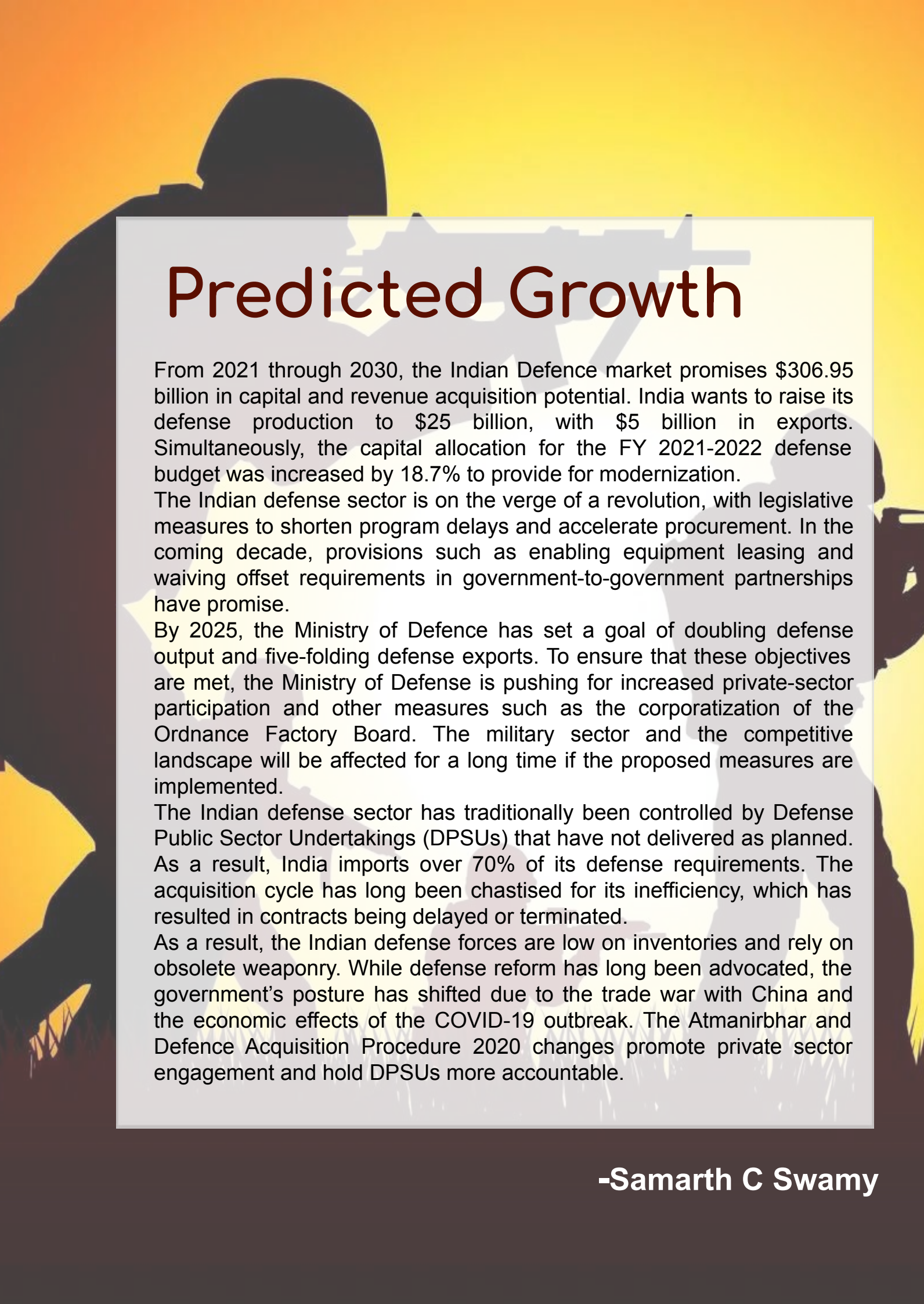
DOWN

1. A hacking attack that tricks victims into clicking on an unintended link or button, usually disguised as a harmless element.
2. An audio or video clip that has been edited and manipulated to seem real or believable
7. A form of malware that deliberately prevents you from accessing files on your computer.
8. A type of malware aimed to corrupt, erase or modify information on a computer before spreading to others
13. A piece of malware that can replicate itself in order to spread the infection to other connected computer.



ACROSS

3. The moment a hacker successfully exploits a vulnerability in a computer or device, and gains access to its files and network
4. A malicious application or script that can be used to take advantage of a computer's vulnerability
5. A group of computers, printers and devices that are interconnected and governed as a whole
6. The process of encoding data to prevent theft by ensuring the data can only be accessed with a key
9. A collection of computers with large storage capabilities that remotely serve requests
10. A set of programs that tell a computer to perform a task
11. Malware that allows cybercriminals to remotely control your computer
12. An umbrella term that describes all forms of malicious software designed to wreak havoc on a computer



Predicted Growth

From 2021 through 2030, the Indian Defence market promises $306.95 billion in capital and revenue acquisition potential. India wants to raise its defense production to $25 billion, with $5 billion in exports. Simultaneously, the capital allocation for the FY 2021-2022 defense budget was increased by 18.7% to provide for modernization.

The Indian defense sector is on the verge of a revolution, with legislative measures to shorten program delays and accelerate procurement. In the coming decade, provisions such as enabling equipment leasing and waiving offset requirements in government-to-government partnerships have promise.

By 2025, the Ministry of Defence has set a goal of doubling defense output and five-folding defense exports. To ensure that these objectives are met, the Ministry of Defense is pushing for increased private-sector participation and other measures such as the corporatization of the Ordnance Factory Board. The military sector and the competitive landscape will be affected for a long time if the proposed measures are implemented.

The Indian defense sector has traditionally been controlled by Defense Public Sector Undertakings (DPSUs) that have not delivered as planned. As a result, India imports over 70% of its defense requirements. The acquisition cycle has long been chastised for its inefficiency, which has resulted in contracts being delayed or terminated.

As a result, the Indian defense forces are low on inventories and rely on obsolete weaponry. While defense reform has long been advocated, the government's posture has shifted due to the trade war with China and the economic effects of the COVID-19 outbreak. The Atmanirbhar and Defence Acquisition Procedure 2020 changes promote private sector engagement and hold DPSUs more accountable.

-Samarth C Swamy

Future plans of India for growth of exports

-Nitesh Bhat

India, which has long been a major importer of weapons, now wants to make military-related trade a two-way street by increasing defense exports. This new focus on military exports has already paid off, with Indian defense exports more than doubling to $330 million in the last year.

Manohar Parrikar, India's ex-defense minister, had set his sights higher, aiming for annual military exports of $2 billion in a few years. While the initial increase in sales was fueled by the removal of excessive controls on military goods, achieving Parrikar's goal would necessitate a shift in Indian diplomacy toward securing weapons contracts for major indigenously developed systems under the government's "Strategy for Defense Exports" (SDE).

Initially, India's defense sales strategy would focus on indigenous missile and naval weapons. Of course, when it joins global export control regimes, India will gradually utilize the numerous international collaborations it has built up over years of co-production and co-development. Overall, India will likely concentrate on a few critical defense partners with the most remarkable strategic alignment to strengthen its global defense industry position.

India made rapid strides in defense in the recent years and is ready to take initiatives for exporting defense equipment in the region. The Defense Research and Development Organization, various PSUs, and the private sector have developed various products for the Indian armed forces. The recently held Aero India 2021 airshow shows that India is eyeing for strong defense cooperation with Indian Ocean Region countries in the face of growing Chinese influence in the region.

13th edition of Aero India
Source: The Indian Express

According to India's training and military cooperation agreements with Vietnam, the latter must assist India in maintaining and improving Russian-made equipment used by both nations' militaries. As a result, the Indian defense industry is ready to collaborate with Vietnamese firms to deliver weapons and sensors that Vietnam may not otherwise receive.

Domestic modernization efforts of Russian and Western origin systems have provided Indian industry with a wealth of experience in combining equipment from many sources to meet various industry standards. As a result, the Indian industry has established itself as a provider of sensor and navigation upgrade packages and standard spares and maintenance services for platforms of diverse origins. These qualities are now reflected in the surge in exports recently.

India’s first warship INS Viraat which was exported to Mauritiu

Source: www.livemint.com

For a long time, East African countries like Mozambique have looked to India to build their coastal fleets, and India may now be able to give. This is demonstrated by the fact that Indian defense shipyards have increased their capacity and productivity due to recent modernization efforts and are now competing for foreign orders.

Meanwhile, India's military will have to step up its diplomatic efforts. The Indian Navy (IN) has grabbed the lead in this domain. It has been critical in ensuring warship exports through partnerships with countries in the Indian Ocean region. Furthermore, as shown above, IN's focus on indigenization has been critical in developing export capacity.

India tappears to understand that the successful export of military systems is dependent on criteria other than price and timeliness. While it has decided not to create a separate military strategy, the SDE has been institutionalized into the Ministry of Commerce's (MoC) broader foreign trade policy, highlighting the geoeconomic objectives underpinning India's defense export .

FUTURE TECHNOLOGIES

-Saransh, Ashrith, Jatin and Sumit

The defence sector has been responsible for many technological advances including, the internet and networking to drones and GPS. Over the years, many nations have invested heavily in Research and development in order to keep one step ahead of the adversary and gain more advantage in the world.

The requirements of peacekeeping and the role of defence forces in aiding civil power should be maximized taking care of the lethal outcomes of defence. There are many technological advances in the defence sector: directed energy weapons, hypersonic, quantum computing, and autonomous weapons. We would be seeing some of the current technologies in defence and then look closely at the future aspects of defence.

Indian Air Force

Advanced Medium Combat Aircraft at Aero India
Source: wikipedia.org

Established in 1932 Indian Air Force (IAF) has come a long way from an auxiliary air force of the British Empire to the standalone air branch of Indian armed forces. The number of aircrafts has been decreasing since the 90s (post Kargil war) owing to the retirement of aircrafts and several crashes. IAF plans to ramp up its current 33 squadrons fleet to 42 squadrons by 2035 and deploy 450 fighter aircrafts each along the contentious borders of China and Pakistan.

The Indian government has signed deals with many national and international aerospace and defense companies to modernise its air fleet. Along with Aeronautical Development Agency and Hindustan Aeronautics Limited, a twin-engine fifth generation aircraft, called Advanced Medium Combat Aircraft (AMCA) is being developed with a prototype expected in 2025. In February 2021, IAF finalized deals with HAL for 83 advanced Tejas Aircrafts.Omni-role Combat Aircraft of Rafale category is also expected in 2026 with service by 2032. Recently, the central government also cleared the proposal to procure 56 C-295MW transport aircraft from Airbus Defence and Space for the IAF. India is also planning to add sixth generation technologies to some variants of 5th generation aircraft such as HAL AMCA.

Indian Army

Similar to the IAF, army is also in a technology crunch compared to other nations. Majority troops of the Indian army still uses assault rifles such as AK 47 which were inducted around 1988, and are outdated. Army has launched an infantry modernisation program, called as Futuristic Infantry Soldier As a System (F-INSAS) which aims to acquire assets based on modern technology for its aviation, armoured and artillery branches. It includes bulletproof jackets and helmets, thermal sensors, night vision devices and a miniature computer with audio headset.

In 2020, the Indian government inked a deal worth rs 880 crores with Israel Weapons Industry for the procurement of 16, 479 Light Machine Guns. India is also developing many indigenious missiles such as Agni, BrahMos, Prahaar, shaurya, nag anti- tank guided missiles. Indian ballistic missile defense programme is a two tiered system consisting of Prithvi Air Defence (pad) missile and Advanced Air Defence (aad) is under development.

F-Insas: Future Infantry Soldier As A System
Source: www.nmlonline.weebly.com

Indian Navy

The Indian navy has also been developing indigenous platforms, systems, sensors and weapons as part of its modernization and expansion plans.

Recently, the navy commissioned the fourth of the Scorpene class submarines and the first of Visakhapatnam class of destroyers into its fleet. India plans to build a strong navy of 200 vessels and 500 aircrafts by 2050. Rs 423 crore deals has also been signed with US department of state for the procurement of mk-54 torpedoes. 2 ballistic missile submarine (SSBN) of Arihant class are under advanced stage of construction, these submarines are capable of deploying submarine-launched ballistic missiles (SLBMs) with nuclear warheads and can avoid advanced detection technologies.3 SSBN of of S5 class is also under development. The Ministry of Defense has cleared the proposal for the 6 attack submarines under P75I project, which tends to acquire 6 diesel-electric submarines.

Type 214 submarine By Germany Under Project 75-I

Future Scope

One of the foremost acute problems during this modern international relation is the expectation of a brand new era of exacerbating strategic competitions, characterized by the confluence of economic, and military-technological competitions within the context of major shifts in the world security of their country.

Quantum Technologies

Quantum technology is a rising field of physics and engineering that supports quantum-mechanical properties—like quantum web, quantum superposition, and quantum tunneling -- that area unit applied to individual quantum systems and their utilization for sensible applications.

Earlier before, the primary quantum revolution brought technologies that are unit-introduced to the USA nowadays, like atomic energy, semiconductors, lasers, resonance imaging, and fashionable communication technologies or digital cameras. The primary quantum technology resulted in energy and its weapons. The classic pc gained a major role. Nowadays, optical device weapons area units are being enforced and tested.

MIlitary Pain Beams

US Active Denial System
Source: www.theguardian.com

If you think what they portray within the movies, armies of the long run can replace bullet-based guns with ray guns just like the phasers employed by the crew of the ballistic capsule Enterprise in "Star Trek." US military has proclaimed that it's developing a brand new technology that closely resembles those art movement weapons. This new directed-energy beam weapon exploits one in all our natural defense mechanisms -- pain.

Anytime we have a tendency to get hurt, we have a tendency to feel pain, and our initial response is to maneuver off from the supply of that pain. As an example, if you bit a hot lightweight bulb, it burns your skin. Your body acknowledges the pain and causes you to jerk your handoff from the sunshine bulb. The natural reaction of jerking your hand off when you accidentally touch some hot body, is the basis for the U.S. military's new pain beam, which burns the surface of the skin so as to move adversaries. officers say that the "non-lethal" weapon, referred to as active-denial technology, does not cause lasting injury to the folks hit by it.

Exoskeleton

You may have come across marvel comics or books and would have encountered several superheroes like Captain America, iron man, and all. it's quite fascinating however normal-looking humans may be given super strength and powers victimization technology. it's quite potential in today's world in addition and therefore the U.S.A. is making one slightly less unimaginable version of Iron Man's suit which will alter U.S. troopers to run quicker, carry heavier weapons, and leap over obstacles on the parcel of land, and at an equivalent time, it will defend them from the results of bullets and bombs.

Laser Weapons

The normal light bulb sends lightweight waves to in each direction. These waves, a bit like waves in water, have peaks and troughs, or high points and low points. There also are voluminous frequencies, or colors, of sunshine coming back from a lightweight bulb, and that they all mix to make what feels like a white lightweight.

An optical device such as laser is additionally centered than a light-weight bulb. It creates just one wavelength, or color, of light. The sunshine beam is also tightly centered and stay thus over nice distances. Lasers will manufacture lightweight of tremendous powers (1,000 to one million times stronger than a typical lightweight bulb).

Ultra short pulse fibre laser
Source: www.militaryaerospace.com

Soldier equipped with powerful exoskeleton
Source: www.roboticsbusinessreview.com

The Indian Armed Forces has over 1.4 million active personnel, making it the world's second largest military force. With the sole objective of protecting the nation from foreign aggression, our armed forces has proved its competency many times. However, due to politics, budgetary constraints and other factors, it has achieved its intended end state. In recent years, many deals have been made for the rapid modernisation and upgradation of our defence systems. India is developing modern technologies capable systems indigenously under programs such as Atmanirbhar Bharat.

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