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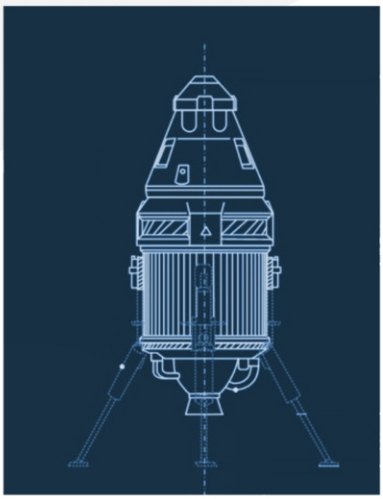
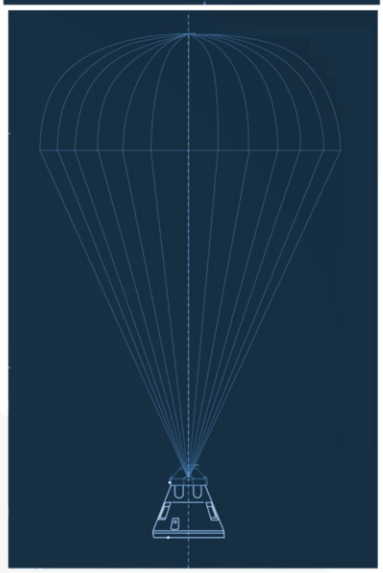
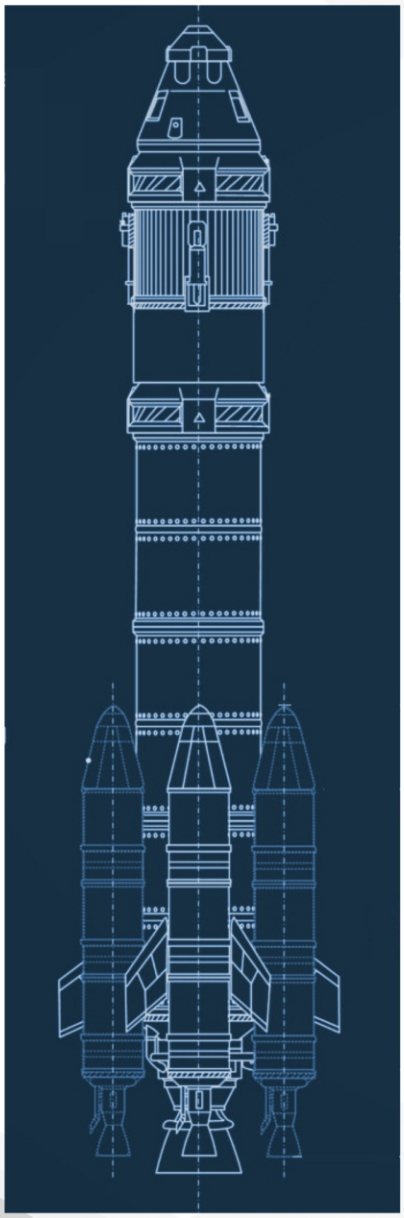
EMANATION

MECHANICAL DEPARTMENT NEWSLETTER







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AFTER ENGINEERING

ELECTROMAGNETIC BOMBING

VOL - 8 | 2019

Sri Y Ramachandra Naidu
President

Sri K Venkatesh Naidu
Secretary

Sri D Rukmangada
Treasurer

Self confidence is the essential ingredient to accomplish a task successfully. It comes by developing the strong belief that something with in is stronger than the task itself. We will support an atmosphere and culture in achieving excellence in engineering for the benefit of our society. We congratulate the Department of Mechanical Engineering for the launch of their 8th vol. of Emanation Newsletter. .

GOOD LUCK

It gives me immense pleasure to pen a few words as prologue to our Mechanical Engineering Department Emanation Newsletter. Emanation provides an intersection of great challenges and opportunity for the students to review there efforts and analyze their achievements who earn credits for the Department and Institution as well. I congratulate the Department and the editorial team for highlighting that students are adequately equipped and possess necessary skill sets to being laurels. I wish that this number may grow in the years to come.

Dr. K. V. A. Balaji
CEO

I am happy to know that the Department of Mechanical Engineering at KSIT is coming out with its Eight edition of the Newsletter Emanation. A college may reach heights of glory without materials like a magazine the outside world may not know of it. **WHEN THE GOING GETS TOUGH, THE TOUGH GETS GOING.** I compliment the entire team including the editorial board and the students for their earnest contribution of creativity.

Dr. T. V Govindaraju
Principal / Director

It gives me a sense of pride and happiness to note the response to this Newsletter of our Department Emanation has been overwhelming. Emanation highlights that our students and professors process potential in ample measures. Commendable job has been done by the Editorial Board is planning and producing the Newsletter. My congratulations to the team who took the responsibility. Most effectively I am hopeful that this small piece of technical and allied work shall not only develop the taste for reading amongst students but also develop a sense belonging to the institution as well.

Prof. M Umashankar
Professor and Head
Mechanical Engg

Thought from Editors

Greetings and a warm welcome to our Eight Edition of "EMANATION". Just like gods and the auras churned the ocean of milk to extract the nectar, we have tried to churn out the creativity from this mess of science. This time we made an attempt to bring out the talented concealed within our community. The issue includes article, resume building, interview with the alumni, research papers and much more. We hope you enjoy reading this issue as much as we have enjoyed making much. Any suggestions or criticism on the newsletter would be welcomed.
Lastly we thank all the members who made this edition possible.

- Team Emanation

"Teachers can open the door, but you must enter it yourself".

INTRODUCTION

The prosecution of a successful Information Warfare (IW) campaign against an industrialized or post industrial opponent will require a suitable set of tools. As demonstrated in the Desert Storm air campaign, air power has proven to be a most effective means of inhibiting the functions of an opponent's vital information processing infrastructure. This is because air power allows concurrent or parallel engagement of a large number of targets over geographically significant areas .

While Desert Storm demonstrated that the application of air power was the most practical means of crushing an opponent's information processing and transmission nodes, the need to physically destroy these with guided munitions absorbed a substantial proportion of available air assets in the early phase of the air campaign. Indeed, the aircrafts capable of delivering laser guided bombs were largely occupied with this very target set during the first nights of the air battle.

The efficient execution of an IW campaign against a modern industrial or post-industrial opponent will require the use of specialized tools designed to destroy information systems. **Electromagnetic bombs** built for this purpose can provide, where delivered by suitable means, a very effective tool for this purpose.

THE ELECTROMAGNETIC EFFECT

The ELECTROMAGNETIC Pulse (EMP) effect was first observed during the early testing of high altitude airburst nuclear weapons [GLASSTONE64]. The effect is characterized by the production of a very short (hundreds of nanoseconds) but intense electromagnetic pulse, which propagates away from its source with ever diminishing intensity, governed by the theory of electromagnetism. The Electromagnetic Pulse is in effect an electromagnetic shock wave.

This pulse of energy produces a powerful electromagnetic field, particularly within the vicinity of the weapon burst. The field can be sufficiently strong to produce short lived transient voltages of thousands of Volts (ie. kilovolts) on exposed electrical conductors, such as wires, or conductive tracks on printed circuit boards were exposed.

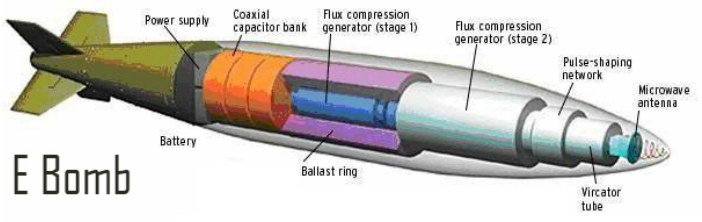
It is this aspect of the EMP effect which is of military significance, as it can result in irreversible damage to a wide range of electrical and electronic equipment, particularly computers and radio or radar receivers. Subject to the electromagnetic hardness of the electronics, a measure of the equipment's resilience to this effect, and the intensity of the field produced by the weapon, the equipment can be irreversibly damaged or in effect electrically destroyed. The damage inflicted is similar to that experienced through exposure to close proximity lightning strikes, and may require complete replacement of the equipment, or at least substantial portions thereof.

Commercial computer equipment is particularly vulnerable to EMP effects, as it is largely built up of high density Metal Oxide Semiconductor (MOS) devices, which are very sensitive to exposure to high voltage transients. What is significant about MOS devices is that very little energy is required to permanently wound or destroy them, any voltage in typically in excess of tens of Volts can produce an effect termed as gate breakdown which effectively destroys the device. Even if the pulse is not powerful enough to produce thermal damage, the power supply in the equipment will readily supply enough energy to complete the destructive process. Wounded devices may still function, but their reliability will be seriously impaired. Shielding electronics by equipment chassis provides only limited protection, as any cables running in and out of the equipment will behave very much like antennae, in effect guiding the high voltage transients into the equipment.

Computers used in data processing systems, communications systems, displays, industrial control applications, including road and rail signaling, and those embedded in military equipment, such as signal processors, electronic flight controls and digital engine control systems, are all potentially vulnerable to the EMP effect.

Other electronic devices and electrical equipment may also be destroyed by the EMP effect. Telecommunications equipment can be highly vulnerable, due to the presence of lengthy copper cables between devices. Receivers of all varieties are particularly sensitive to EMP, as the highly sensitive miniature high frequency transistors and diodes in such equipment are easily destroyed by exposure to high voltage electrical transients. Therefore radar and electronic warfare equipment, satellite, microwave, UHF, VHF, HF and low band communications equipment and television equipment are all potentially vulnerable to the EMP effect.

It is significant that modern military platforms are densely packed with electronic equipment, and unless these platforms are well hardened, an EMP device can substantially reduce their function or render them unusable.



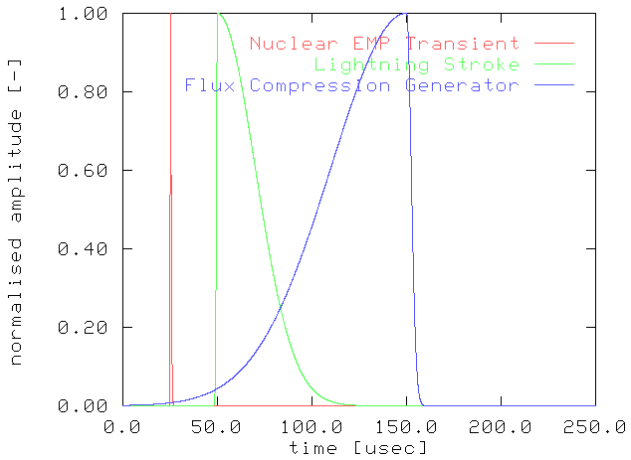
DID YOU KNOW ?

Electromagnetic energy can occur as radiated, electric or magnetic or a conducted electric current depending on the source.

The Technology Base for Conventional Electromagnetic Bombs

The technology base which may be applied to the design of electromagnetic bombs is both diverse, and in many areas quite mature. Key technologies which are extant in the area are explosively pumped Flux Compression Generators (FCG), explosive or propellant driven Magneto-Hydrodynamic (MHD) generators and a range of HPM devices, the foremost of which is the Virtual Cathode Oscillator or Vircator. A wide range of experimental designs have been tested in these technology areas, and a considerable volume of work has been published in unclassified literature.

This paper will review the basic principles and attributes of these technologies, in relation to bomb and warhead applications. It is stressed that this treatment is not exhaustive, and is only intended to illustrate how the technology base can be adapted to an operationally deployable capability.



Explosively Pumped Flux Compression Generators

The explosively pumped FCG is the most mature technology applicable to bomb designs. The FCG was first demonstrated by Clarence Fowler at Los Alamos National Laboratories (LANL) in the late fifties [FOWLER60]. Since that time a wide range of FCG configurations has been built and tested, both in the US and the USSR, and more recently CIS.

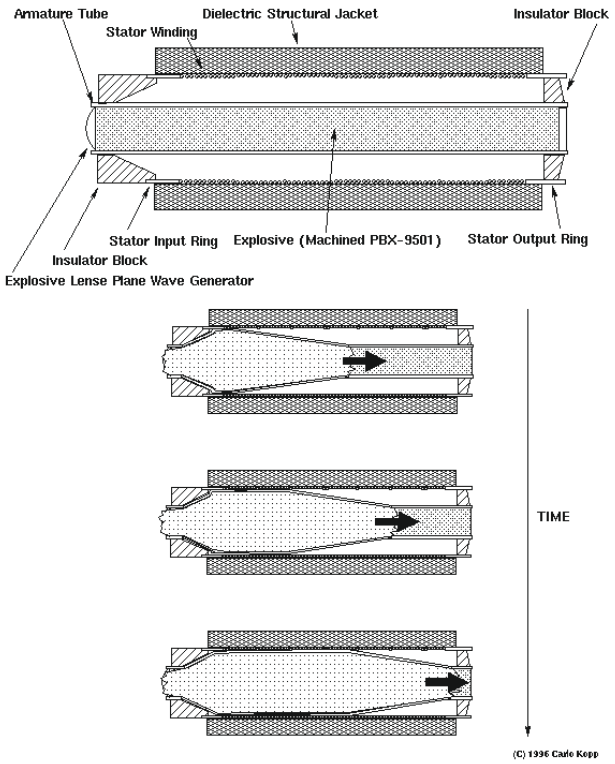
The FCG is a device capable of producing electrical energies of tens of MegaJoules in tens to hundreds of microseconds of time, in a relatively compact package. With peak power levels of the order of TeraWatts to tens of TeraWatts, FCGs may be used directly, or as one shot pulse power supplies for microwave tubes. To place this in perspective, the current produced by a large FCG is between ten to a thousand times greater than that produced by a typical lightning stroke [WHITE78].

The central idea behind the construction of FCGs is that of using a fast explosive to rapidly compress a magnetic field, transferring much energy from the explosive into the magnetic field.

The initial magnetic field in the FCG prior to explosive initiation is produced by a start current. The start current is supplied by an external source, such a a high voltage capacitor bank (Marx bank), a smaller FCG or an MHD device.

In principle, any device capable of producing a pulse of electrical current of the order of tens of kiloAmperes to MegaAmperes will be suitable.

A number of geometrical configurations for FCGs have been published (for examples see REINOVSKY85, CAIRD85, FOWLER89) The most commonly used arrangement is that of the coaxial FCG. The coaxial arrangement is of particular interest in this context, as its essentially cylindrical form factor lends itself to packaging into munitions.



EXPLOSIVELY PUMPED COAXIAL FLUX COMPRESSION GENERATOR

In a typical coaxial FCG , a cylindrical copper tube forms the armature. This tube is filled with a fast high energy explosive. A number of explosive types have been used, ranging from B and C-type compositions to machined blocks of PBX-9501. The armature is surrounded by a helical coil of heavy wire, typically copper, which forms the FCG stator. The stator winding is in some designs split into segments, with wires bifurcating at the boundaries of the segments, to optimise the electromagnetic inductance of the armature coil.

The intense magnetic forces produced during the operation of the FCG could potentially cause the device to disintegrate prematurely if not dealt with. This is typically accomplished by the addition of a structural jacket of a non-magnetic material. Materials such as concrete or Fibreglass in an Epoxy matrix have been used. In principle, any material with suitable electrical and mechanical properties could be used. In applications where weight is an issue, such as air delivered bombs or missile warheads, a glass or Kevlar Epoxy composite would be a viable candidate.

It is typical that the explosive is initiated when the start current peaks. This is usually accomplished with a explosive lense plane wave generator which produces a uniform plane wave burn (or detonation) front in the explosive.

Once initiated, the front propagates through the explosive in the armature, distorting it into a conical shape (typically 12 to 14 degrees of arc). Where the armature has expanded to the full diameter of the stator, it forms a short circuit between the ends of the stator coil, shorting and thus isolating the start current source and trapping the current within the device. The propagating short has the effect of compressing the magnetic field, whilst reducing the inductance of the stator winding. The result is that such generators will producing a ramping current pulse, which peaks before the final disintegration of the device. Published results suggest ramp times of tens to hundreds of microseconds, specific to the characteristics of the device, for peak currents of tens of MegaAmperes and peak energies of tens of MegaJoules.

The current multiplication (ie ratio of output current to start current) achieved varies with designs, but numbers as high as 60 have been demonstrated. In a munition application, where space and weight are at a premium, the smallest possible start current source is desirable. These applications can exploit cascading of FCGs, where a small FCG is used to prime a larger FCG with a start current. Experiments conducted by LANL and AFWL have demonstrated the viability of this technique [KIRTLAND94, REINOVSKY85].

The principal technical issues in adapting the FCG to weapons applications lie in packaging, the supply of start current, and matching the device to the intended load. Interfacing to a load is simplified by the coaxial geometry of coaxial and conical FCG designs. Significantly, this geometry is convenient for weapons applications, where FCGs may be stacked axially with devices such a microwave Vircators. The demands of a load such as a Vircator, in terms of waveform shape and timing, can be satisfied by inserting pulse shaping networks, transformers and explosive high current switches.

Targeting Electromagnetic Bombs

The task of identifying targets for attack with electromagnetic bombs can be complex. Certain categories of target will be very easy to identify and engage. Buildings housing government offices and thus computer equipment, production facilities, military bases and known radar sites and communications nodes are all targets which can be readily identified through conventional photographic, satellite, imaging radar, electronic reconnaissance and humint operations. These targets are typically geographically fixed and thus may be attacked providing that the aircraft can penetrate to weapon release range. With the accuracy inherent in GPS/inertially guided weapons, the electromagnetic bomb can be programmed to detonate at the optimal position to inflict a maximum of electrical damage.

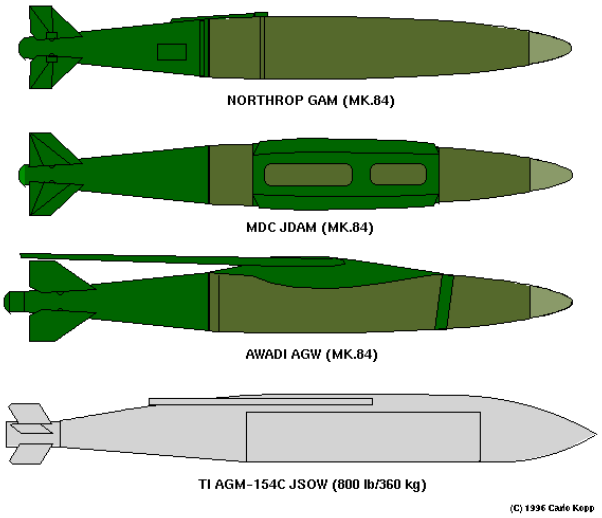
Mobile and camouflaged targets which radiate overtly can also be readily engaged. Mobile and relocatable air defence equipment, mobile communications nodes and naval vessels are all good examples of this category of target. While radiating, their positions can be precisely tracked with suitable Electronic Support Measures (ESM) and Emitter Locating Systems (ELS) carried either by the launch platform or a remote surveillance platform. In the latter instance target coordinates can be continuously data linked to the launch platform. As most such targets move relatively slowly, they are unlikely to escape the footprint of the electromagnetic bomb during the weapon's flight time.

Mobile or hidden targets which do not overtly radiate may present a problem, particularly should conventional means of targeting be employed.

A technical solution to this problem does however exist, for many types of target. This solution is the detection and tracking of Unintentional Emission (UE) [HERSKOWITZ96]. UE has attracted most attention in the context of TEMPEST surveillance, where transient emanations leaking out from equipment due poor shielding can be detected and in many instances demodulated to recover useful intelligence. Termed Van Eck radiation [VECK85], such emissions can only be suppressed by rigorous shielding and emission control techniques, such as are employed in TEMPEST rated equipment.

Whilst the demodulation of UE can be a technically difficult task to perform well, in the context of targeting electromagnetic bombs this problem does not arise. To target such an emitter for attack requires only the ability to identify the type of emission and thus target type, and to isolate its position with sufficient accuracy to deliver the bomb. Because the emissions from computer monitors, peripherals, processor equipment, switchmode power supplies, electrical motors, internal combustion engine ignition systems, variable duty cycle electrical power controllers (thyristor or triac based), superheterodyne receiver local oscillators and computer networking cables are all distinct in their frequencies and modulations, a suitable Emitter Locating System can be designed to detect, identify and track such sources of emission.

A good precedent for this targeting paradigm exists. During the SEA (Vietnam) conflict the United States Air Force (USAF) operated a number of night interdiction gunships which used direction finding receivers to track the emissions from vehicle ignition systems. Once a truck was identified and tracked, the gunship would engage it .



GPS GUIDED BOMB/GLIDEBOMB KITS

Because UE occurs at relatively low power levels, the use of this detection method prior to the outbreak of hostilities can be difficult, as it may be necessary to overfly hostile territory to find signals of usable intensity .
The use of stealthy reconnaissance aircraft or long range, stealthy Unmanned Aerial Vehicles (UAV) may be required. The latter also raises the possibility of autonomous electromagnetic warhead armed expendable UAVs, fitted with appropriate homing receivers. These would be programmed to loiter in a target area until a suitable emitter is detected, upon which the UAV would home in and expend itself against the target.

Electronic Combat Operations using Electromagnetic Bombs

The central objective of Electronic Combat (EC) operations is the command of the electromagnetic spectrum, achieved by soft and hard kill means against the opponent's electronic assets. The underlying objective of commanding the electromagnetic spectrum is to interrupt or substantially reduce the flow of information through the opponent's air defence system, air operations environment and between functional elements of weapon systems.

In this context the ability of electromagnetic bombs to achieve kills against a wide range of target types allows their general application to the task of inflicting attrition upon an opponent's electronic assets, be they specialised air defence assets or more general Command-Control-Communications (C3) and other military assets.

Electromagnetic bombs can be a means of both soft and hard electrical kill, subject to the lethality of the weapon and the hardness of its target. A hard electrical kill by means of an electromagnetic device will be achieved in those instances where such severe electrical damage is achieved against a target so as to require the replacement of most if not all of its internal electronics.

Electronic combat operations using electromagnetic devices involve the use of these to attack radar, C3 and air defence weapon systems. These should always be attacked initially with an electromagnetic weapon to achieve soft or hard electrical kills, followed up by attack with conventional munitions to preclude possible repair of disabled assets at a later time. As with conventional SEAD operations, the greatest payoff will be achieved by using electromagnetic weapons against systems of strategic importance first, followed in turn by those of operational and tactical importance [KOPP92].

In comparison with an AntiRadiation Missile (ARM - a missile which homes on the emissions from a threat radar), the established and specialised tool in the conduct of SEAD operations, an electromagnetic bomb can achieve kills against multiple targets of diverse types within its lethal footprint. In this respect an electromagnetic device may be described as a Weapon of Electrical Mass Destruction (WEMD). Therefore electromagnetic weapons are a significant force multiplier in electronic combat operations.

A conventional electronic combat campaign, or intensive electronic combat operations, will initially concentrate on saturating the opponent's electronic defences, denying information and inflicting maximum attrition upon electronic assets. The force multiplication offered by electromagnetic weapons vastly reduces the number of air assets required to inflict substantial attrition, and where proper electronic reconnaissance has been carried out beforehand, also reduces the need for specialised assets such as ARM firing aircraft equipped with costly emitter locating systems.

The massed application of electromagnetic bombs in the opening phase of an electronic battle will allow much faster attainment of command of the electromagnetic spectrum, as it will inflict attrition upon electronic assets at a much faster rate than possible with conventional means. Whilst the immaturity of conventional electromagnetic weapons precludes an exact analysis of the scale of force multiplication achievable, it is evident that a single aircraft carrying an electromagnetic bomb capable of concurrently disabling a SAM site with its collocated acquisition radar and supporting radar directed AAA weapons, will have the potency of the several ARM firing and support jamming aircraft required to accomplish the same result by conventional means. This and the ability of multirole tactical aircraft to perform this task allows for a much greater concentration of force in the opening phase of the battle, for a given force size.

In summary the massed application of electromagnetic weapons to Electronic Combat operations will provide for a much faster rate of attrition against hostile electronic assets, achievable with a significantly reduced number of specialised and multirole air assets . This will allow even a modestly sized force to apply overwhelming pressure in the initial phase of an electronic battle, and therefore achieve command of the electromagnetic spectrum in a significantly shorter time than by conventional means.

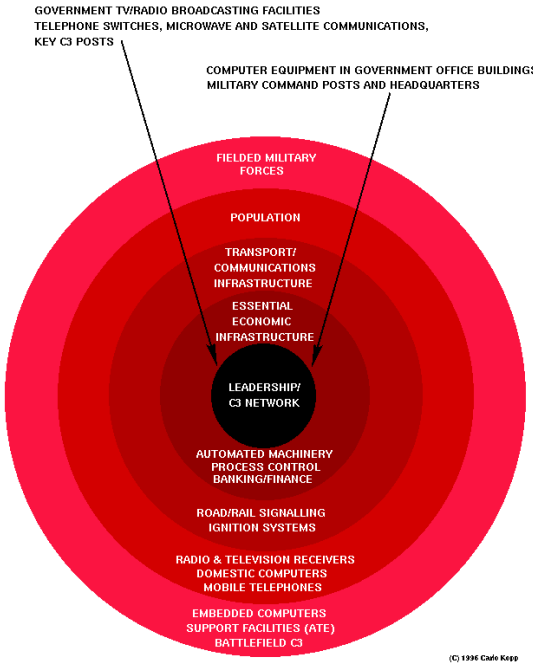


FIG.12 WARDEN'S "FIVE RINGS" STRATEGIC AIR ATTACK MODEL
IN THE CONTEXT OF ELECTROMAGNETICALLY VULNERABLE TARGET SETS

Limitations of Electromagnetic Bombs

The limitations of electromagnetic weapons are determined by weapon implementation and means of delivery. Weapon implementation will determine the electromagnetic field strength achievable at a given radius, and its spectral distribution. Means of delivery will constrain the accuracy with which the weapon can be positioned in relation to the intended target. Both constrain lethality.

The long term effects of a sustained and concentrated strategic bombing campaign using a combination of conventional and electromagnetic weapons will be important. The cost of computer and communications infrastructure is substantial, and its massed destruction would be a major economic burden for any industrialised nation. In addition it is likely that poor protection of stored data will add to further economic losses, as much data will be lost with the destroyed machines.

In the context of targeting military equipment, it must be noted that thermionic technology (ie vacuum tube equipment) is substantially more resilient to the electromagnetic weapons effects than solid state (ie transistor) technology. Therefore a weapon optimised to destroy solid state computers and receivers may cause little or no damage to a thermionic technology device, for instance early 1960s Soviet military equipment. Therefore a hard electrical kill may not be achieved against such targets unless a suitable weapon is used.

This underscores another limitation of electromagnetic weapons, which is the difficulty in kill assessment. Radiating targets such as radars or communications equipment may continue to radiate after an attack even though their receivers and data processing systems have been damaged or destroyed. This means that equipment which has been successfully attacked may still appear to operate. Conversely an opponent may shut down an emitter if attack is imminent and the absence of emissions means that the success or failure of the attack may not be immediately apparent.

Assessing whether an attack on a non radiating emitter has been successful is more problematic. A good case can be made for developing tools specifically for the purpose of analysing unintended emissions, not only for targeting purposes, but also for kill assessment.

An important factor in assessing the lethal coverage of an electromagnetic weapon is atmospheric propagation. While the relationship between electromagnetic field strength and distance from the weapon is one of an inverse square law in free space, the decay in lethal effect with increasing distance within the atmosphere will be greater due quantum physical absorption effects . This is particularly so at higher frequencies, and significant absorption peaks due water vapour and oxygen exist at frequencies above 20 GHz. These will therefore contain the effect of HPM weapons to shorter radii than are ideally achievable in the K and L frequency bands.

Means of delivery will limit the lethality of an electromagnetic bomb by introducing limits to the weapon's size and the accuracy of its delivery. Should the delivery error be of the order of the weapon's lethal radius for a given detonation altitude, lethality will be significantly diminished. This is of particular importance when assessing the lethality of unguided electromagnetic bombs, as delivery errors will be more substantial than those experienced with guided weapons such as GPS guided bombs.

Therefore accuracy of delivery and achievable lethal radius must be considered against the allowable collateral damage for the chosen target. Where collateral electrical damage is a consideration, accuracy of delivery and lethal radius are key parameters. An inaccurately delivered weapon of large lethal radius may be unusable against a target should the likely collateral electrical damage be beyond acceptable limits. This can be a major issue for users constrained by treaty provisions on collateral damage .

INTERVIEW WITH PIONEER

Ms. Jahnavi B V graduated in the year 2015 from this institution and is currently working as a **Design Engineer** at Sandvik Mining and Rock Technology. she was awarded **Best Outgoing Student-**

Why did you choose KSIT?

It was my choice to pursue Mechanical Engineering. KSIT was renowned for its Mechanical Engineering Department, so my obvious choice was KSIT.

How was your experience at KSIT?

KSIT has given a bag load of experiences which has shaped me through the journey of four years. It has given a platform for the overall development requirement for a student. We were encouraged to take part in technical workshops, sports and cultural events. Most importantly, life in our department is worth mentioning. During the first year, I was the only girl among 125 students. Never have I felt alone. The teachers and department staff were always supporting.

Can you share any of your cherished memory at KSIT?

There are innumerable memories to pen down. However personally I feel being confessed for the award of 'Best Outgoing Student-2015' was the best among these. Amidst so many talented individuals to win that was overwhelming.
What are the things that you miss a lot about college and especially our Department?
I do miss our labs. Definitely I miss 'Ananya'. I also miss our volleyball team loving to the Department. I miss organizing events. It gives a lot of experience at people management and miss our teachers too.

What was your final year project and how was your experience doing it?

Our final year project was 'Shape Memory Alloy based Appendage Hotel Down Release Mechanism for Spacecrafts' worked for ISRO. It gave us an exposure to product lifecycle development. From design and analysis of the mechanism, we also got material to get it manufactured. Testing was also carried out. Working under the guidance of experienced sides internally and externally gave us an insight to the real world of application of engineering skills.

Who are your role models?

Swami Vivekananda
From my childhood days, I am been moulded with the stories and teachings of Swami Vivekananda. Contemporarily, I do look up to Smt Sudha Murthy as a role model. Being simple is the hardest thing to adopt. Yet she is inspiring with the life lessons she given out through stories.

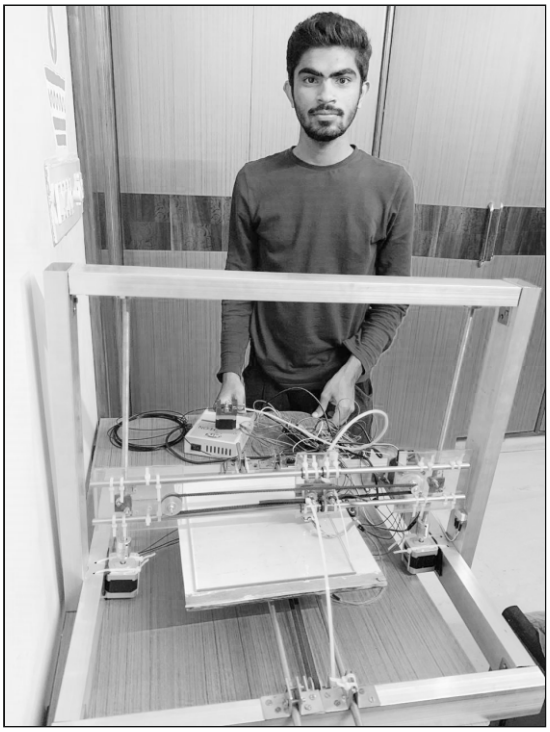
DID YOU KNOW ?

High altitude nuclear EMP is likely to cause catastrophic damage to electronics in vast regions across thousands of kilometres

STUDENT ACHIEVEMENTS

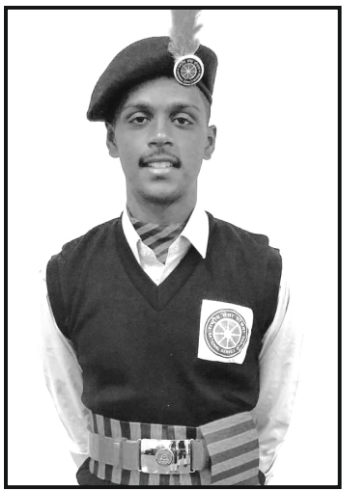
- **BUILD YOUR OWN 3-D PRINTER ! YOU CAN DO IT !**

Mr.Rajath N R of 5th Sem Mechanical dept. has done a project on 3-D printing. 3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file and additive processes. In an additive process an object is created by laying down successive layers of material(PLA) until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object. 3-D printing enables you to produce complex shapes using less material than traditional manufacturing methods The material used is PLA. Polylactic Acid (PLA) is different than most thermoplastic polymers which are derived from renewable resources like corn starch or sugar cane. Most plastics, by contrast, are derived from the distillation and polymerization of nonrenewable petroleum reserves. Plastics that are derived from biomass (e.g. PLA) are known as "bioplastics." **"IT CAN BE RECYCLED" "ECO-FRIENDLY PRINTING"**.

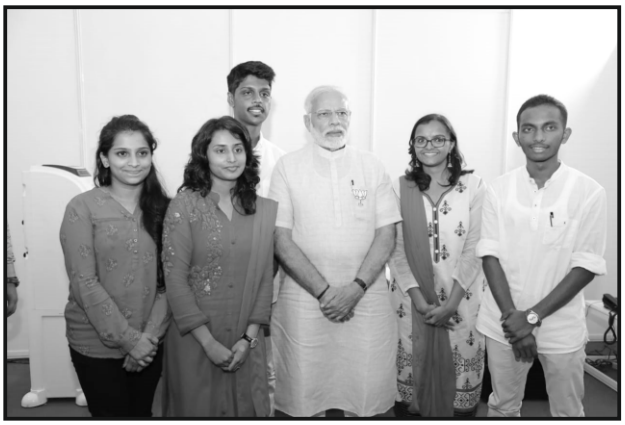


- The project "Automated Pesticide Sprayer for Agricultural farmlands" done by students of mechanical engineering with the guidance of Anil Kumar sir and lead by Praveen Kumar got selected for the all India level competition IICDC (India Innovation Challenge and Design Contest) which was organized by Department of Science and technology, India and sponsored by Texas Instruments. And became one of the finalists which totally comprised of 20 teams. At the beginning of the competition there were a total of 10035 teams which got reduced to top 20 by different rounds conducted by the IICDC panel. The project was mainly based on solar energy and chain drive mechanism for its motion and controlled by microcontroller MSP430G2ET. At last we were able to secure the GOLD certificate from IICDC after so much hardwork and team work . It almost took a year to complete the event which comprised of many rounds such as online tests and MOOC , video submissions, project proposal submission,etc. The team members were: Akash K L, Chethan N, Darshan Gowda S, Parikshith K Kashyap , Praveen Kumar[TL].

- Mr. Sirish Govardhan has taken part as a NSS Volunteer in the State Republic day parade in Bengaluru.

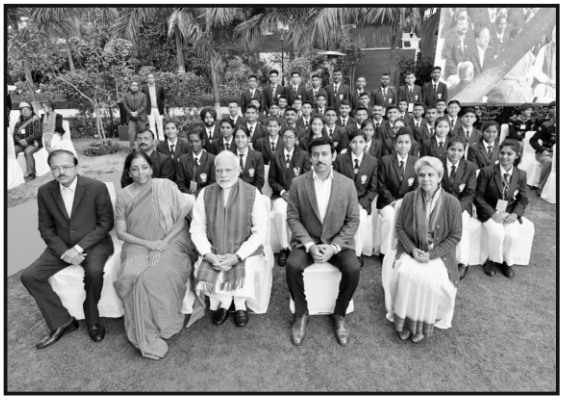


- Mr. Vinay and Mr. Sirish Govardhan got First place in the Power Point presentation organized by New Bengaluru for New India and got an opportunity to meet the honorable Prime Minister of India Mr. Narendra Modi.



- Mr. Prajwal Krishna 7th Sem Mechanical represented VTU cricket team in south zone inter-university Cricket tournament held at VTU Belagavi from 14th January 2019 to 23rd January 2019.

- Mr. Vinay V P of 7th Sem Mechanical was selected for Indian Youth Delegation to Kyrgyzstan from 07 to 14 September 2019.



The Second and Third Year students of Mechanical Engineering completed a training program with hands on experience in **"Industrial Automation and Advanced Manufacturing"** from 23-01-2019 to 05-02-2019 at **Bosch Vocational Training Center, Bengaluru**.

The Second and Third Year students of Mechanical Engineering completed a workshop on **"Robotics with RASPBERRY PI3 using Python"**.

The Second and Third Year students of Mechanical Engineering completed a 3 day workshop on **HVAC designing** conducted by Prinston Smart Engineer.

- The Second and Year students of Mechanical Engineering attended a **International Seminar on 75 Students Satellites Mission 2022** conducted by Indian Technology Congress on 4th and 5th September 2019.

PUBLICATIONS BY FACULTY

- Mr.Nagprasad.K.S Associate Prof. published a paper titled "EGR, DPF and DOC Techniques for Comprehensive Reduction of emissions for engine fuelled with Diesel/DEE blends by three approaches", communicated to SAE FISITA 2018 World Automotive Congress, 2 – 5 October, 2018 to be held at Chennai, India.

- Mr.Nagprasad.K.S Associate Prof. published a paper titled "Performance, Combustion and Emissions of Diesel Engine with different combustion chambers, exhaust gas recirculation rates and aftertreatment devices", has communicated to International Journal of Sustainable Engineering, Taylor and Francis Publications, 2018.

- Mr.Nagprasad.K.S Associate Prof. published a paper titled "Effects of Using Diesel Particulate Filter and Diesel Oxidation Catalyst with Exhaust Gas Recirculation on the Performance of Compression Ignition Engine Fuelled with Diesel- Di Ethyl Ether Blend", communicated to European Journal of Sustainable Development Research, 2018.

- Mr Murlidhar.K.S, Assistant Prof., published a paper titled "Construction of indoor positioning system using trilateration and Rtti fingerpoint." In the journal IJMTE Vol-8 issue X October 2018.

- Mr Murlidhar.K.S, Assistant Prof., published a paper titled "Emission control and fuel efficient by using arduino based self- regulating biomass stove" in the journal IJMTE Vol-8 issue X October 2018

- Mr Ranganath N, Assistant Prof. published a paper titled "characterization of biodegradable polymer subject to different solvent mixture", in the journal IJERT ,ISSN:2278-0181,Vol 7,Issue 12, December-2018.

- Mr Ranganath N, Assistant Prof. published an e-paper titled "Characterization of mechanical and thermal properties of biopolymer nanocomposites", in the journal IJERT ,ISSN:2278-0181,Vol 7,Issue 12, December-2018.

100% RESULTS

Mr. Anil Kumar A	**Kinematics of Machines.**
Mr. Manjunath B R	**Mech measurements and Metrology.**
Mr. Mallikarjuna M R	**Metal Forming.**
Mr. Gautham S	**Industrial safety.**
Mrs. Sreesudha N	**Total Quality Management.**
Mr. Naresha K	**Industrial safety.**
Mr. Manjunath K V	**Additive Manufacturing.**
Mr. Nagabhushan M	**Product Life Cycle Management.**
Mrs. Nirmala L	**Additive Manufacturing.**
Mr. Gautham S	**Product Life Cycle Management.**
Dr. Ajay Kumar B S	**Metal Casting and Welding.**
Mr. Girish T R	**Theory of Elasticity.**
Mr. Bharath Kumar K R	**Non Traditional Machining.**
Mr. Naresha K	**Non Traditional Machining.**
Mr. Murlidhar K S	**Energy and Environment.**
Dr. K V A Balaji	**Project Management.**
Mr. Parashurashuram A K	**Energy Engineering.**
Mr. Umashankar M	**Control Engineering.**
Mr. Ranganath N	**Fluid Power Systems.**
Mr. Harish U	**Mechatronics.**
Mr. K Prasad	**Energy Engineering.**
Mr. Manjunath B R	**Fluid Power Systems.**
Mr. Manjunath K V	**Control Engineering.**
Mr. Mallikarjuna M R	**Tribology.**
Mr. Naresha K	**Mechatronics.**

Massive Open Online Course (MOOC)

A Massive Open Online Course (MOOC) is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials, such as filmed lectures, readings, and problem sets, many MOOCs provide interactive courses with user forums to support community interactions among students, professors, and teaching assistants, as well as immediate feedback to quick quizzes and assignments. Few of the top MOOC providers are:

- EdX (US)
- FutureLearn (UK)
- XuetangX (China)
- Kadenze (US)
- Coursera (US)
- SWAYAM (India)
- Udacity (US)
- MéxicoX / (Mexico)

SWAYAM is India's national MOOC platform. It offers over 2,150 courses taught by close to 1,300 instructors from over 135 Indian universities. One aspect that sets it apart from other providers is that it allows students in India to earn academic credit online. Since the platform was launched in 2017, over 10 million learners have taken courses on SWAYAM. The courses hosted on SWAYAM are in 4 quadrants - (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts.

Courses delivered through SWAYAM are available free of cost to the learners, however learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated centres on specified dates. Eligibility for the certificate will be announced on the course page and learners will get certificates only if these criteria are matched. Universities/colleges approving credit transfer for these courses can use the marks/certificate obtained in these courses for the same. In order to ensure that best quality content is produced and delivered, National Programme on Technology Enhanced Learning (NPTEL) has been appointed as the National coordinator for Engineering programme.

The National Programme on Technology Enhanced Learning (NPTEL) is a Government of India sponsored collaborative educational programme. By developing curriculum-based video and web courses the programme aims to enhance the quality of engineering education in India. It is being jointly carried out by 7 IITs and IISc, Bangalore and is funded by the Ministry of Human Resources Development of the Government of India.
NPTEL offers wide range of courses during every academic semester across all domains of engineering categorized into three types based on the duration of the course and their respective credits:
i) 4 weeks (1 credit) ii) 8 weeks (2 credits) iii) 12 weeks (3 credits)
Choose a specific course that suits your interest especially if you are preparing for higher education or job switch or want to expand your intellect in a structured way.

Benefits of these courses and certification:

- It helps in professional growth.
- The certificate adds up the reputed college tag on the CV.
- It keeps one motivated to complete the course. Moreover, it sends a message to the interviewer that you are a self-driven individual and highly motivated towards your work. Learn and gain knowledge on subject matters that are not included in the regular curriculum.

https://swayam.gov.in/
https://nptel.ac.in

DID YOU KNOW ?

A nuclear electromagnetic pulse is the abrupt pulse of electromagnetic radiation resulting from a nuclear explosion. Very high electric field strengths can cause breakdown of the air and a potentially lethal arc current similar to lightning to flow

AFTER ENGINEERING

Well, there are many sectors like automotive, construction, oil and natural gas, consulting firms, piping, etc. where lot of mechanical engineers work. But more or less the life of most of these engineers are same.

First thing, it depends on what exactly you want to do in future.

1. **Higher Studies** – If you want to pursue higher studies, again there are various options available
   a. Technical - M Tech (GATE) or M.S. (GRE)
   b. Management – MBA (CAT, MAT etc.)

2. **After Engineering courses**:

a) **Postgraduate Diploma in Human Resource Management:** Is the oldest and most prestigious programme. The program targets expanding HR leaders by challenging critical thinking and concentrating on renovations in these fields. You will learn from the basics functions such as devising and organizing to compensation management and performance categorization.

b) **PGDM in Digital Marketing**: PGDM in Digital Marketing course assists scholars in understanding the ideas and tools which will help companies in digitizing themselves. After completing PGD in Digital Marketing students are able to make their career as a successful Digital Media Marketer. Post Graduate Diploma holders in Digital Marketing will earn an average salary from 3lacs to 6lacs per annum.

3. **Machine Learning:** Experts predict that Artificial Intelligence is the future. Machine learning is a subfield of computer science that evolved from the study of pattern recognition and computational learning theory in artificial intelligence.

Further information about various exams:

1. **GATE** : A national level examination, GATE **(Graduate Aptitude Test in Engineering)** is a qualifying exam for admissions to post-graduate programs (eg - ME, M Tech, direct PhD) in Indian Institutes of higher education with financial assistance provided by MHRD and other Government agencies.

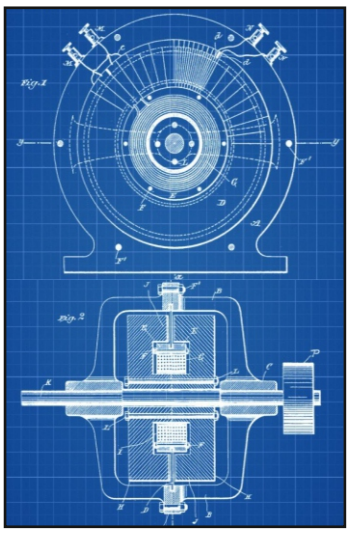
2. **The GMAT** : (**Graduate Management Admission Test**) is a 3.5 hour standardized exam designed to predict how test takers will perform academically in MBA (Masters in Business Administration) programs. GMAT scores are used by graduate business schools to make admission decisions.

NOTE : Schools that do not require GMAT or GRE scores generally have relatively lenient admission standards and/or are located outside North America.

3.**GRE/ TOEFL/ IELTS :** For pursuing MS in US, AUSTRALIA, GERMANY ,UK. So this no longer country specific but university specific. TOEFL is a language test and is preferred in the US but in most other countries including all European countries prefer IELTS. GRE is often not required outside the US.

NEXT EDITION

ELECTRIC VEHICLES



Mobility and fossil fuels have been inextricably linked with electric, over the last decade, a collection of circumstances have conspired to create an opening for electric mobility to enter the mass market like Advances in renewable energy, battery chemistry, energy security, data capture and analysis.

Increasing efficiency of vehicles: Incentivizing developments to increase vehicle effciency, thereby reducing energy consumption, can enable to a vehicle to travel the same distance on a smaller battery pack. Energy efficiency can be enhanced by using more efficient electric motors.

India has a lot to gain by converting its ICE vehicles to EVs at the earliest. Its oil-import bill would considerably reduce. ICE vehicles are a major contributor to pollution in cities and their replacement with EVs will definitely improve air quality. There is a considerable possibility that we can become leaders in small and public electric vehicles. India has over 170 million two-wheelers. If we assume that each of these vehicles uses a little more than half a liter of petrol per day or about 200 liters per year, the total amount of petrol used by such vehicles is about 34 billion liters. At Rs.70 per liter, this would cost about Rs.2.4 lakh crores. Even if we assume that 50% of this is the cost of imported crude (as tax and other may be 50%), one may save 1.2 lakh crores worth of imported oil. There is a real possibility of getting this done in the next five to seven years. This would however require innovations, a policy regime that encourages access to latest technologies and a concerted effort by the Indian industry to achieve global competition through acquiring the necessary scale and using cutting edge technology.

EDITORIAL COMMITTEE

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- Mr. Umashankar M
- Mr. Anil Kumar A

STUDENT COMMITTEE

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- Kushal Rao R
- Prithvi B
- Tejas P