PIIT Journal of Mechanical Engineering

ISSN 2277-5951

Vol.2 - No.2 - December 2012

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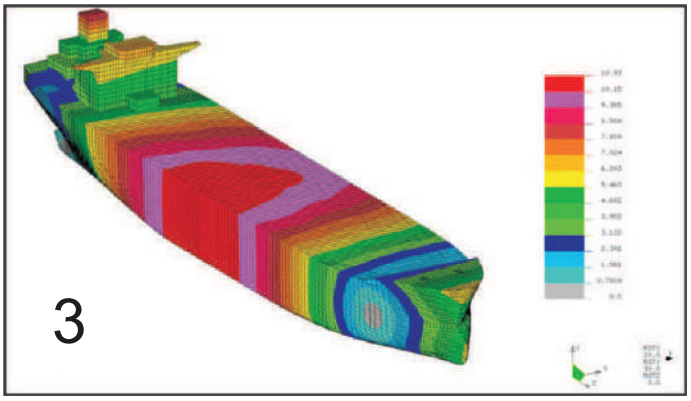
Science at its best



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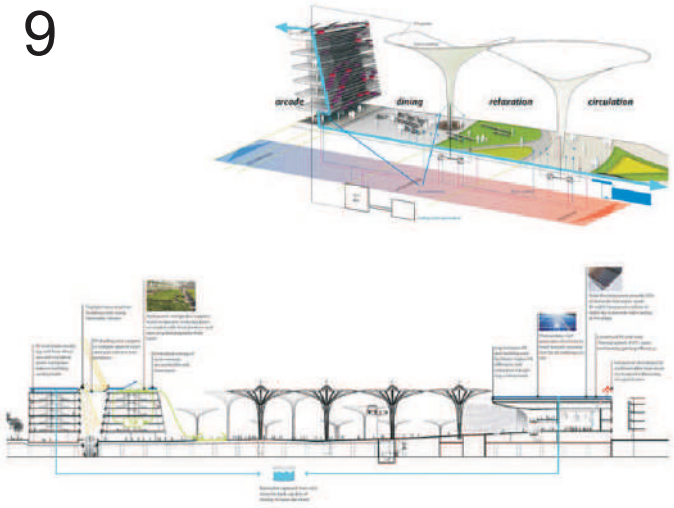

Current events

Theme

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The Science of Naval Architecture

Hydrostatics

It concerns the conditions that the vessel is subjected to while at rest in the water, and its ability to remain afloat, as well as factors such as displacement, buoyancy and stability. Buoyancy and its resultant upward force are given by the following equations, where B is buoyancy force, g is acceleration due to gravity, m is mass of the vessel, V is volume of the hull, and p(f) is fluid density. The weight of the ship is considered as a single force acting downwards from a single point called the center of gravity. The upward force exerted by the water is considered a single force called the buoyant force, and is assumed to be acting from a single point called the Center of buoyancy. As long as the two points are in equilibrium, the ship will remain stable. In general, the lower a ship is riding in the water, the more stable it is. Ballast is used to lower the Center of gravity to enhance stability.

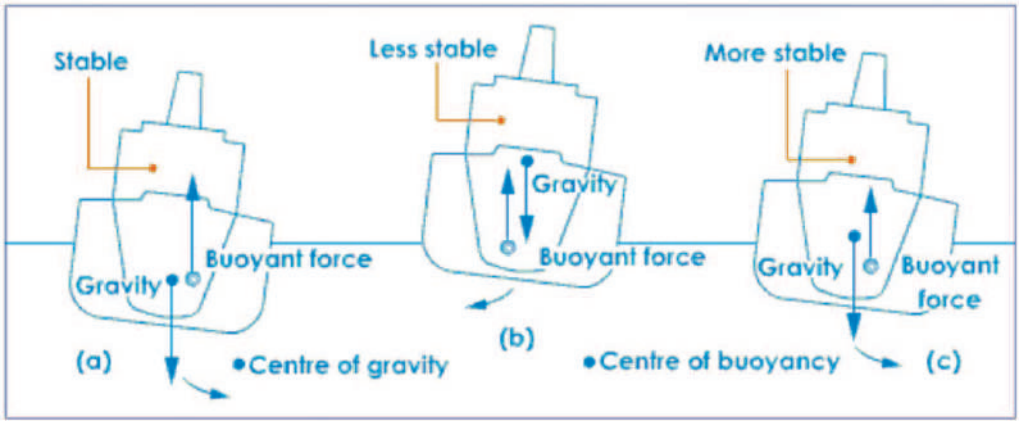


Figure (a)when center of gravity acts downwards and buoyant force acts upwards(B)

$$a = \frac{g(\rho_f V - m)}{m + \rho_f V}$$

$$B = \frac{2gm\rho_f V}{m + \rho_f V}$$

Hydrodynamics

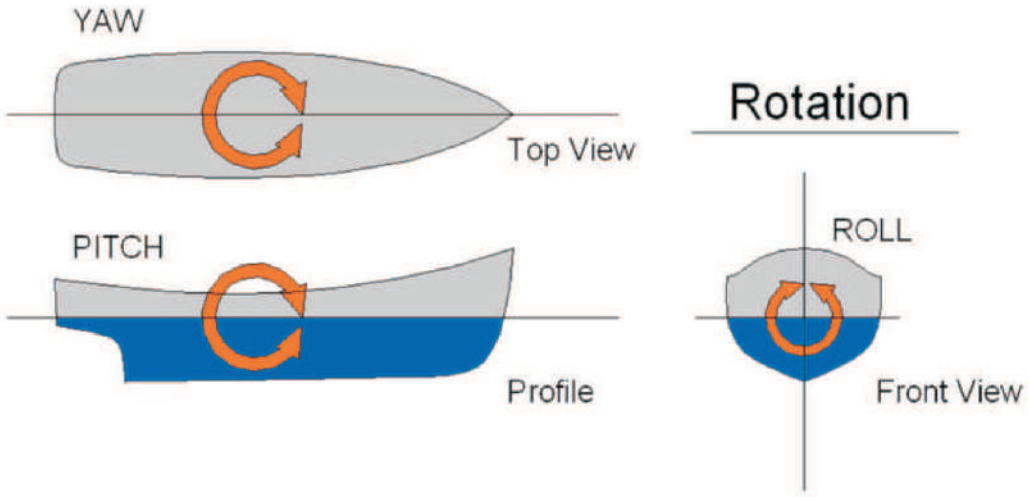


Figure 2 pitch yaw and roll

It is the study of the flow of water around and under the hull of a ship, as well as its interaction with various features like propellers, rudders etc. These factors cause resistance to the water flow, and the ship itself will be acted upon by forces caused by tides, currents, waves and wind. In general, a ship is most stable, and can move most easily when the flow of water is laminar. Hence, to reduce turbulent flow, all ship designs have to be modelled in miniature, as well as mathematically, to ensure reduction in turbulent flow. All this eventually is used to determine the Controllability of the vessel. This involves maintaining position and direction of the vessel while in motion. The concept of Ship Motions is used to practically relate hydrodynamics to shipbuilding. These are the six degrees of freedom that a ship in motion has.

1. **Heave** is the linear vertical (up/down) motion.
2. **Sway** is the linear lateral (side-to-side) motion.
3. **Surge** is the linear longitudinal (front/back) motion.
4. **Roll** is the rotation of a vessel about its longitudinal (front/back) axis.
5. **Pitch** is the rotation of a vessel about its transverse (side-to-side) axis.
6. **Yaw** is the rotation of a vessel about its vertical axis.

Structural Analysis

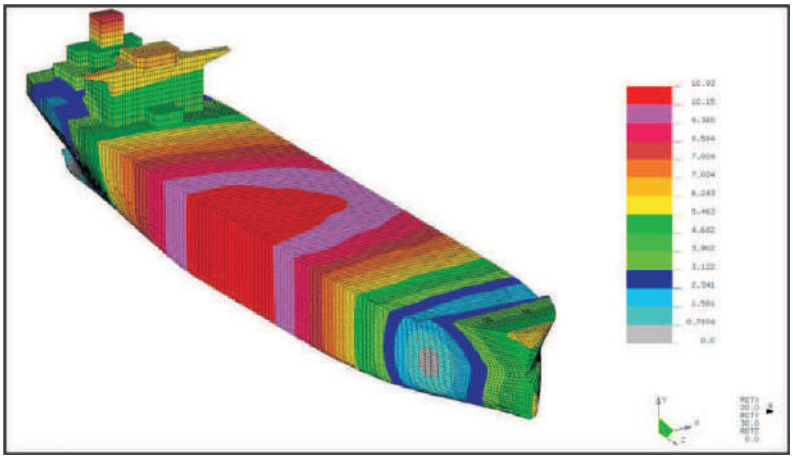
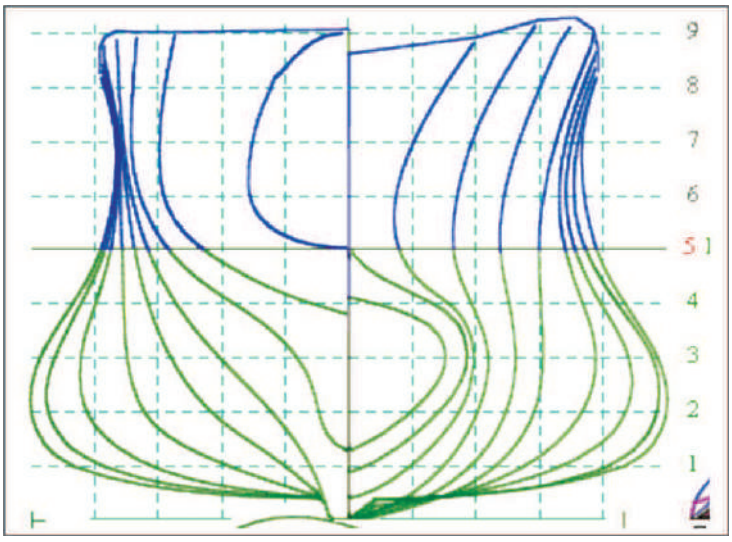


Figure 3 fea

It involves the selection of various materials for construction, analysis of local and global strength of vessel components, and vibrations in structural components during operation and motion. Design work may be conducted using a ship model basin. Such modelling is usually computerized, as ships are extremely complex structures, with sections and segments being constructed from many different materials, with different behaviour under the effects of load, vibrations, temperature shifts, mechanical stress, fluid contact etc. Care must be taken to select the correct materials for building the vessel, especially the hull. Additionally, seemingly small factors like the type of paint used, the type of waterproofing, the material of the rivets can have a significant impact upon the performance of the vessel in marine conditions. Simple techniques like the methods of Joints and Sections do not give satisfactory results, and ships are too complex to reduce to the relatively simple models needed to employ them. Hence, the most common method used in Naval Structural analysis is the Finite Element Method. FEM allows detailed visualization of where structures bend or twist, and indicates the distribution of stresses and displacements. FEM software provides a wide range of simulation options for controlling the complexity of both modelling and analysis of a system. Similarly, the desired level of accuracy required and associated computational time requirements can be managed simultaneously to address most engineering applications. FEM allows entire designs to be constructed, refined, and optimized before the design is manufactured.

Construction



The method of construction employed depends largely upon the construction materials used, which in turn depends upon the Structural analysis of the behaviour of the ship. Modern ships are made of materials that are both light and strong, and react well under large stress. In the case of steel or aluminium, construction techniques involve welding, cutting, rolling and bending as per structural design drawings, followed by erection and launching. Other methods are used for new materials like fibre reinforced plastic and glass reinforced plastic. Modern shipbuilding makes considerable use of prefabricated sections. Entire multi-deck segments of the hull or superstructure will be built elsewhere in the yard, transported to the building dock or slipway, and then lifted into place. This is known as "block construction". The most modern shipyards pre-install equipment, pipes, electrical cables, and any other components within the blocks, to minimize the effort needed to assemble or install components deep within the hull once it is welded together. Modern ships, since roughly 1940, have been produced almost exclusively of welded steel. Specialized steels such as ABS Steels with good properties for ship construction have been used. To ensure motion stabilization, static hull features such as skegs and bilge keels, or active mechanical devices like counterweights, anti-roll tanks, and stabilizers are installed on all ships.

- By JAIDEV RAMAKRISHNA, T. E. Comps

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Shock & Awe

A Political, Economic, Legal and Military Analysis of Modern Piracy

The Second Oldest Profession in the World

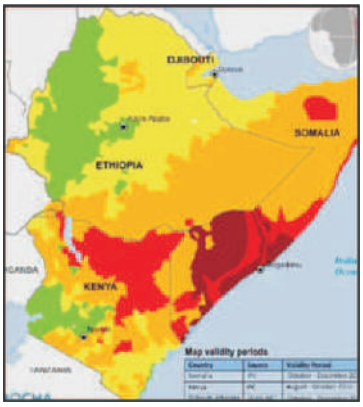
As long as man has plied the oceans for commerce, there have been those who would unlawfully capture men and goods by force, for their own profit. At one time, these people were considered dashing heroes, living exciting lives of adventure on the wild side of the law. The reality was much less romantic – pirates were most often poor, unemployed people who were fleeing from criminal justice. The hard and violent lifestyle – lack of food and water, diseases like Scurvy and Bubonic plague, and the risk of death in combat – ensured that most pirates had very short careers, even assuming that they did not end up hanged for their crimes. This reality has not changed over the ages, and remains valid even in our modern world of air travel, powerful naval forces and swift justice. Modern pirates are driven by the same factors – perceived societal injustice, poverty, and a need to escape the failed states that cannot provide a basic humane standard of living. These factors have contributed to the resurgence of Piracy in modern times, after it died out once the Medieval European Powers like Britain and Spain feilded navies large enough to police the seas effectively. This article will concentrate on the Arabian Sea region, off the coasts of East Africa and the Arabian Penninsula, since most modern piracy takes place here.

Pirates of the Arabian

Akin to the Spice Route and the Grand Trunk Road of ancient times, the modern Sea Lines of Communication (SLOC) is the main route through which goods flow from east to west. China's large service and labour classes, combined with its lax policies concerning worker wages, industrial health hazards and forced labour, have made it the world's largest, and most profitable manufacturing center. It manufactures everything from luxury items like the iPhone, to the cheap consumer goods – like toys, clothes and religious idols – that have flooded markets. It follows then, that the volumes of raw materials flowing in, and the finished products flowing out, would be massive. The proximity of other manufacturing centers in the region – Thailand, Taiwan, the Philippines and Japan – emphasize the need for a massive trade presence. This monumental manufacturing and trade presence is what has turned China into the Economic powerhouse that it is today. From one analysis, 60 – 70% of the world's maritime trade flows through this corridor. In fact, 50% of the world's largest merchant ships passed through the region in 2011. Another factor is that the SLOC cover all the important ports on the Indian Ocean.

- From Europe, through the Suez Canal.
- Through the Red Sea, Gulf of Aden and Persian Gulf.
- To India through the Arabian Sea and Bay of Bengal.
- Through the South China Sea, to China.

Blowing the Horn of Africa



The Horn of Africa is a peninsula in that juts hundreds of miles into the Gulf of Aden, and includes the countries of Djibouti, Ethiopia and Somalia and Kenya. It is one of the poorest regions in the world, constantly ravaged by drought, civil wars, water shortages, disease and economic insolvency. The map on the right uses Food Security as a metric to measure the wellbeing of the population of an area. The worst affected areas are in North Eastern Kenya, and Coastal and Southern Somalia, with the region around the capital city of Mogadishu being given a "Catastrophe" rating. Somalia is located South West of the "River of Gold" that is the SLOC. The largest freighters in the world, loaded with the most valuable cargos, ply in this area, and promise a rich reward to any pirate daring and resourceful enough to capture them. Most pirates here are former fishermen who have lost their livelihoods due to pollution or over fishing. The total worth of a freighter, its cargo and its crew's ransom can come to several hundred million dollars, which is a large prize for someone from an impoverished country like Somalia. Piracy started growing after the end of the Somalian Civil War, and by 2005, it threatened global shipping enough for major Freight lines, Industrial conglomerates and Governments to take note of it.

Money, Money, Money

Pirate income derived from ransoms was estimated at around $238 million in 2010, and the average ransom was $5.4 million. However, by 2011, pirate ransom income dropped to $160 million, a downward trend which has been attributed to intensified counter-piracy efforts. During the height of the piracy phenomenon in 2008, local residents complained that the presence of so many armed men made them feel insecure and that their free spending ways caused wild fluctuations in the local exchange rate. A 2010 report suggested that piracy off the coast of Somalia lead to a decrease of revenue for Egypt as fewer ships use the Suez Canal (estimated loss of about $642 million), impeded trade with neighboring countries, and negatively impacted tourism and fishing in the Seychelles. According to Sky News, around 50% of the world's containers passed through the Horn of Africa coastline as of 2012. The European Union Naval Force has a yearly budget of over 8 million Euros earmarked for patrolling the 3.2 million square miles.

Funding for pirate cartels has become highly organized, to the point where a Stock Market operates in the city of Harardhere. Here, private investors can buy and sell stock in various upcoming attacks by pirate cartels. The returns come out of profits gained from a successful seizure of a vessel and its cargo, and the payment of a ransom for its crew. Ransom money is paid in large denomination US Dollar bills, loaded into waterproof sacks or briefcases, which are dropped by helicopter, parachuted onto a ship's deck or hand delivered in small boats. Pirates use portable currency counting machines to authenticate and count the bills. These machines have been traced to sellers in Dubai and Djibouti. In 2008, there were allegations of pirates having received financial and material assistance from sympathetic members of the Somalian Diaspora based in Canada. The U.N Counter Piracy division stated that in 2011, Islamic militant groups like Al – Shabaab, based in the southern Arabian Peninsula, were cooperating with pirates to bolster their own dwindling resources and operational reach. Al – Qaeda has also been tied to these operations, as they control many areas where pirates operate. They have been reported as charging protection money, as well as 20% of ransom amounts.

…And Justice for All

The Legal Situation in most cases of piracy is unproblematic, when, for example, the attack is perpetrated in the territorial waters of a particular country by nationals of that country against a ship belonging to and flagged by the same country. In such cases the only constraint is the actual ability of this country's law-enforcement agencies (mainly its coastguard or equivalents), its court system and national legislation. However, in most cases—at least those of interest to the international community—the situation is much more complex. For example - a hypothetical (but not at all unlikely) situation in which a ship belonging to a third party observes and considers whether to act to prevent an attack by pirates against a ship belonging to another nation on the border of the territorial waters of yet another state.

United Nations laws cause more problems that arise when dealing with pirates. In theory, they only apply in international waters, while a particular nation's laws apply only in its territorial waters. The fact is that every member of the UN (which includes most countries) is in some way bound by UN law, and is bound to follow any charters ratified by it. Points upon which these different sets of laws differ create legal loopholes and grey areas. These may create problems during the trial, where the accused may be able to get off on technicalities relating to violation of due process. In rare cases, these conflicts may even cause a lengthy delay in bringing the case to trial in the first place.

Other factors which further complicate the legal mix include –

- **Human Rights** – While the laws of most nations do not infringe upon the Declaration of Human Rights, certain readings of various criminal and maritime law codes may allow a more broad interpretation of Humane Treatment. Also, aboard naval vessels which are on long term deployments, where space and various resources are limited, it may not always be possible to provide the

best conditions for confinement of prisoners.

- **Maritime Law** – Vessels of different countries follow their own maritime laws. These laws may conflict with the laws of the country in whose waters the capture of pirates occurred.
- **Naval Operating Doctrine** – Various navies may interpret piracy in different ways – all the way from Threats of Force to Acts of War.
- **Competent Authority** – Who exactly has the right to prosecute pirates is debatable. As long as they are upon a naval ship, they can be shipped anywhere the personnel choose. In a country's territorial waters, its own laws apply. In international waters, the country under whose flag captured ships and personnel were sailing has a right to try them according to its own laws, although this rarely occurs in practice.

Outclassed and Outmaneuvered

Pirates can be divided into 3 categories –

- **Fishermen** – Former fishermen are the masterminds of the piracy operations, due to their in depth knowledge of local conditions.
- **Ex Militia** – They fought for various local warlords during the civil war, but are now unemployed.
- **Technicians** – They operate and repair the vessels and weapons, as well as GPS and Radio equipment.

Pirate vessels are usually of 2 types –

- **Skiffs** - These are small fiberglass motor boats and other craft that are fast and highly maneuverable. These are usually refitted fishing boats, or other craft captured in raids. They mount no offensive or defensive weapons or armour. These skiffs can reach a maximum speed of 25 knots. This is higher than the maximum speeds of larger vessels. Combined with deft handling, the advantage of surprise, and with numbers on their side, they can easily run down and surround slow merchant vessels.
- **Mother Ships** – They control and coordinate raids and other operations. They include captured merchant vessels, and larger fishing vessels, which may have been refitted to mount minimal on deck weaponry. The presence of these ships has simplified and expanded the logistical capabilities of pirates, and has allowed them to extend their operations further and further into the Indian Ocean every year, and today, they may be capable of threatening the coast of India itself.

Weapons that pirates use have been shown to come mostly from Yemen and Mogadishu. The strife torn disputed regions of the Arabian Peninsula are home to various Warlords and other armed factions, that are ready to sell arms for money or captured vessels and cargo. The pirate factions pay an advance to the arms dealers, which then deliver the weapons to a designated point on the mainland, at which point the rest of the payment is made. Their weapons are much more sophisticated than their vessels.

- **Assault Rifles** – AKMs and other AK47 variants.
- **Heavy weapons** – RPG 7s and other cheap grenade launchers.
- **Explosives** – RGD 5 and F1 Hand Grenades
- **Light arms** – TT 30s and other semi automatic pistols.

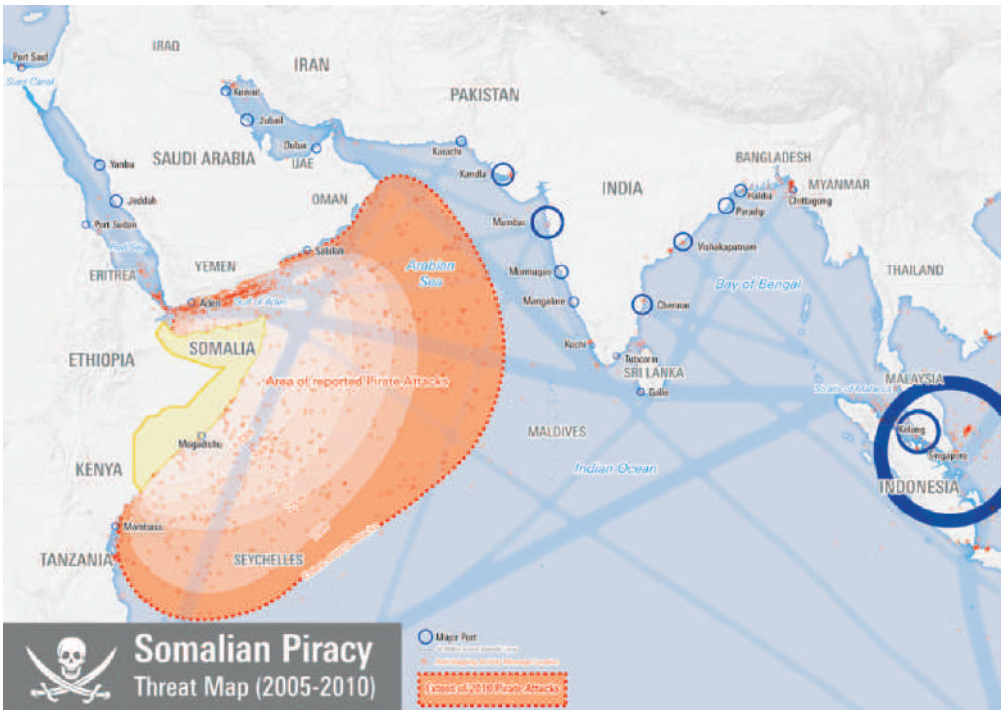
Other Equipment that pirates use include –

- GPS Devices
- Portable Radio Transmitters
- Portable Currency Counters
- Light Ladders and Grapples

The Best Defense is a Good Offense

We may subdivide counter-piracy into three categories of measures –

- **Preventative** - Intended to make both actual and prospective pirates abandon their activities.
- **Offensive** - Intended to defeat pirates, thereby preventing the launch of pirate attacks in the future. Direct military action by naval vessels falls under this category.



- **Defensive** - Intended to protect shipping against pirates.

Somalian pirates prefer the "kidnap and ransom" approach rather than the "hit and run" approach. Most pirate attacks occur during the early hours of the morning, before dawn. Mother ships stalk the intended target from the rear, until they are inside operational range, at which point, speed boats are launched. Heavy weapons deployed from the ship fire across the bow of the freighter, as a warning to stop. By this time, the small boats are in range, and the pirates fire their own warning shots from assault rifles, to intimidate the operator into cutting the engines. This "Shock and Awe" approach is what makes such operations effective, as the weapons used by pirates are usually too light to seriously cripple a craft as large as a freighter or oil tanker.

Compared to the number of pirates, the number of naval ships deployed in the Arabian Sea is miniscule. In fact, the Indian Navy, which has been one of the most active ones in combating piracy, never had more than 2 destroyers deployed at any given time. The fact is that, for all their aggressive tactics, pirate ships are incapable of facing even the smallest of naval vessels. This is because they mount no on board weapons or armour, and are relatively slow. A single hit from a projectile weapon is capable of crippling or destroying the ship. In fact, the mere presence of naval vessels is enough to deter piracy in the area.

Standard protocol requires that naval vessels offer pirates the chance to surrender. This offer may be accompanied by warning shots fired across the bow. At this point, most pirate ships choose to retreat, or abandon ship in their light craft in case they are already well within range of the naval vessel's weapons. Pirate ships that choose to fight back are rare, and the one instance in which an Indian Cruiser was attacked by pirates resulted in the complete destruction of the pirate ship, along with all hands. A more delicate situation arises in case hostages are present. In this case, the naval vessels will target the propellers or bridge of the ship, instead of going for kill shots. Once the pirate ship has stopped, armed Marines in small launches board the ship to free the hostages and arrest the pirates.

In Conclusion

Piracy occurs in The Arabian Sea due to the following factors –

- Poor economic conditions and standards of living in the region.
- A sympathetic general population, filled with discontent by the interference of western powers.
- Inadequate preventive measures by merchant and naval fleets operating in the area.
- Failure of world governments and regulatory bodies to recognize the growing threat in the past decade.

- By JAIDEV RAMAKRISHNA, T. E. Comps

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GOING GREEN TOWARDS A SUSTAINABLE LIFE

The World Commission on Environment and Development has put forth a definition of "sustainability" as meeting the needs of present without compromising the ability of future generations to

meet their own needs.

Environmental consciousness formally came into the picture globally at UNCED (United Nations Conference on Environment and Development)'s Earth Summit held at Rio in 1992. Governments of the world recognized that there is a new global effort to relate the elements of the international economic system and mankind's need for a safe and stable natural environment.

The meeting was a milestone in moving towards greener tomorrow. Principles on economy of resources, life cycle design and humane designs were discussed thoroughly. Towards the ending, strategies on energy, water and material conservation, pre-building, building and post-building phases were gone over.

Another great milestone was the introduction of LEED (Leadership in Energy and Environmental Design). It consists of a suite of rating systems for the design, construction and operation of high performance green buildings, homes and neighborhoods.

Developed by the U.S. Green Building Council (USGBC), and spearheaded by Robert K. Watson, Founding Chairman LEED Steering Committee from 1995 until 2006, LEED is intended to provide building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.

Since its inception in 1998, the U.S. Green Building Council has grown to encompass more than 7,000 projects in the United States and 30 countries, covering over 1.501 billion square feet (140 km^2) of development area. The hallmark of LEED is that it is an open and transparent process where the technical criteria proposed by USGBC members are publicly reviewed for approval by the almost 20,000 member organizations that currently constitute the USGBC.

The Green Building Certification Institute (GBCI) was established by USGBC to provide a series of exams to allow individuals to become accredited for their knowledge of the LEED rating system. This is recognized through either the LEED Accredited Professional (LEED AP) or LEED Green Associate (LEED Green Assoc.) designation. GBCI also provides third-party certification for projects pursuing LEED.

CaseStudies

TZed homes, Bangalore

The company of TZed homes in Whitefield, Bangalore has been certified as the first residential apartment in the world to be rated 'Platinum' under LEED. TZed, which means "Towards Zero Energy Development" is a 249,000 sq. ft. green project spread across 5.5 acres and is designed to reduce lighting and energy by nearly 70 per cent.

The features that help in bringing down energy consumption in the homes are:

- Zero electricity refrigerators,
- Fully controlled air conditioning based 100 % on fresh air inputs,
- Ammonia-based chilling unit (non-ozone depleting product)
- Built-in energy efficient lights

Even the materials selected were in such a manner that they required less production energy hence lowering carbon emissions.Brick , Stone that reduce carbon emission through savings on resources and embodied energies, incorporating fly ash blocks, to save the amount of steel and cement used. External walls are built using laterite blocks and finishing treated with fine waterproof coating. This ensures that surfaces are non-erodable, need no external paint applications and are thermally efficient.

Rubberwood – door shutters and flooring

Palmwood – External walkway decking

Bamboo – Partially used in roofing and interior woodwork .

Water collected from the roofs, stored in shallow aquifers, through a system of drains, percolation pits, trenches , wells recharge wells are dug to help water percolation through the ground into the shallow zone. Solar water pumps draw water from the shallow aquifers into a transit tanks from where it is sent for ozonizing thereby making it potable. Then it is sent to small overhead tanks for daily storage before it reaches the homes.All wastewater is treated (filtration, aeration and ozonization) to be reused for gardens in a way that such water eventually percolates into the open wells and so completing the loop of use and generation.

Organic waste are converted into Vermicompost(nutrient-rich natural fertilizer and soil conditioner to be used for the garden) in vermicomposting pits. Black water from the toilets -Sewage Treatment Plant (anaerobic digester where 70% of the biological matter is decomposed.)Grey water -decentralised water treatment system (irrigation of herbs, plants and grass and finally joins the shallow aquifer.)

Green Business Center, Hyderabad

The CII-Sohrabji Godrej Green Business Centre (also known as CII or CIIGBC) earned a LEED® rating of 56 credits and became certified LEED Platinum for New Construction in 2003 - the first in India and the first outside of the U.S. An impressive 77 % of the building materials use recycled content in the form of fly ash, broken glass, broken tiles, recycled paper, recycled aluminium, waste of sugarcane, cinder from industrial furnace, mineral fibres and quarry dust, the wood was also sustainably harvested.

The 20,000-square-foot building was designed around a courtyard-a traditional gathering place for intellectual encounters, cultural functions and social interactions-which acts as a "light well", providing light to the adjoining rooms. The natural light from the courtyard, combined with energy-efficient lighting systems, results in 88 per cent energy savings, higher than tha t of an electrically-lit building of the same size.

Sensors detect the illumination levels from the courtyard and trigger the deployment of efficient electric lighting. Dimmers control the illumination levels by turning off unnecessary lighting.90 per cent of building spaces have daylight access and views to the outside. Certain areas use jaalis to prevent glare and heat gain, while facilitating ventilation and having visual and aural connection with the outside.

A roof top grids (solar photovaltaic cell) provides about 24 kilowatts, or about 16 percent of buildings electricity needs. Other side there are two wind towers, these are traditional architectural element that catch air and cool it as it passes down the tower.

The Druk White Lotus school, Ladakh

The Druk White Lotus School is a small Buddhist school under the patronage of the Dalai Lama, and founded by His Holiness the 12th Gyalwang Drukpa in 1992.

The school has been designed to optimize use of natural resources such as solar radiation, shading, and natural ventilation. The facility has its own energy and reduces local emissions by using solar panels that take maximum advantage of Ladakh's high and consistent exposure to direct sunlight.

Key Sustainable Features

- Using locally-available materials, which have the least impact on the environment;
- Exploiting natural ventilation and passive solar heating;
- Minimizing energy use and emissions;
- Minimizing water use;
- Refining and adapting traditional techniques to provide modern solutions.

Water is a limited resource in a region with very little rainfall. The main source of water is snowmelt from the surrounding Himalayas. The water distribution system reuses water for irrigation and directs any rainfall to planted areas. Groundwater from the 105-foot (32-meter) deep water table is pumped by solar power to a 16,000-gallon (60,000 liter) tank at the surface.Drinking and irrigation water is then gravity fed to gardens and water faucets. When not driving the water pump, the solar panels feed batteries used to power the school's computers. The school's toilets use a “ventilated improved pit” system, considered an important and affordable breakthrough for improving sanitation in developing countries. The system uses no water but has a solar-driven flue to eliminate smells and insects.The roofs need good insulation to minimize heat transfer in both winter and summer. The roof is made from a combination of mud and local wood. Rock wool and felt are used to insulate.On top of this they have added corrugated

aluminum sheets and sand to cover the felt to prevent it from melting under the constant sunshine.

Auroville

Auroville is a universal township in the making for a population of up to 50,000 people from around the world.The concept of Auroville - an ideal township devoted to an experiment in human unity.The purpose of Auroville is to realise human unity – in diversity. Today Auroville is recognised as the first and only internationally endorsed ongoing experiment in human unity and transformation of consciousness, also concerned with - and practically researching into - sustainable living and the future cultural, environmental, social and spiritual needs of mankind.

Sustainable Technology and Design in Auroville

Technology plays an important role in the pursuit for sustainable living. Within Auroville, several research institutes are continuously working on innovative processes to reduce energy and water use by modifying and integrating new and existing technologies

Solar Technology

The most common application of solar technology is for water pumping, water heating, street lighting, and in some cases electricity generation.

Solar Electricity

Some communities and buildings run completely on electricity produced by photovoltaic (PV) panels. Currently, there are 400 houses running solely on solar electricity within Auroville.

Solar water pumping and heaters

Over 80% of the solar technology in Auroville is used for water pumping and heating. Many of the operations for the waste water systems, and well/boreholes rely on this form of energy to move the water.

Wastewater Technology

Underground containment and pre-filtration tanks, and overhead oxygenating and polishing ponds. For commercial and urban spaces that have little space for ponds, the institute has designed a cylindrical vortex system which takes advantage of centrifugal and centripetal forces to filter and oxygenate the water.

Wind Technology

The few projects that do take advantage of this renewable technology use the power generated solely for their water systems.

Rainwater Harvesting

Building designs has begun to incorporate rainwater harvesting into structural design. Prompted by the alarmingly decreasing rate of the water tables in the area, the inclusion of rainwater capture and

storage facilities has become highly common in Auroville

Architecture and design within Auroville is highly experimental around natural architecture. Natural architecture takes advantage of local available building materials, as well as the layout and contours of the project site. By effectively planning the building design, the architect can take advantage of the natural lighting and wind direction to reduce the need for artificial lighting and cooling systems.

There are two main inputs being experimented with in Auroville

1.Ferro-Cement

Ferro-cement is made using chicken mesh plastered in mortar (cement, sand and water). Ferro-cement

- Requires less material than reinforced cement.
- Has economic advantage, very flexible and is the appropriate material for 'niche applications'.
- Ideal construction material for infrastructure that is periodically/seldom used, and requires minimal design intricacies (such as school buildings, religious buildings)

2.Earth Blocks

- Earth Blocks are building blocks made of soil, sand, and 5% of cement mixture. Aside from the eco-friendly input used in the production process, the use of soil from the site surroundings reduces the embodied energy since there is less need for transportation, mechanized block production, and firing processes amongst others.
- According to the Earth Institute, Embodied energy for a finished wall made of eblocks is 19 percent less than concrete solid blocks, and over 70 percent less than fired brick.
- Naturally possesses aesthetic earthen look .
- Humidity regulation provided
- and the low maintenance it requires in the long run

Green School, Bali

The Green School was a finalist in the 2010 Aga Khan Awards for Architecture, which honors projects that exhibit architectural excellence as well as improve people's overall quality of life.

Comprised of a campus of buildings all built with bamboo, the Green School serves as a learning laboratory for bamboo construction and architectural expression.

The entire campus is managed with a focus on sustainability.

They strive to have the "lowest carbon footprint of any international school anywhere," which is partially made possible by their extensive use of locally grown bamboo, their on-campus food production, and plans for power generation on site.

The campus is powered by a number of alternative energy sources, including a bamboo sawdust hot water and cooking system, a hydro-powered vortex generator and solar panels.

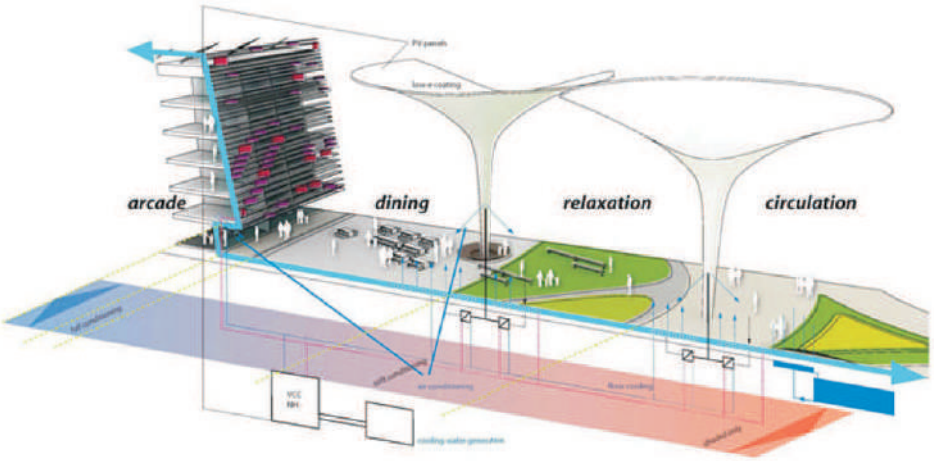
MasdarCity,Abu Dhabi

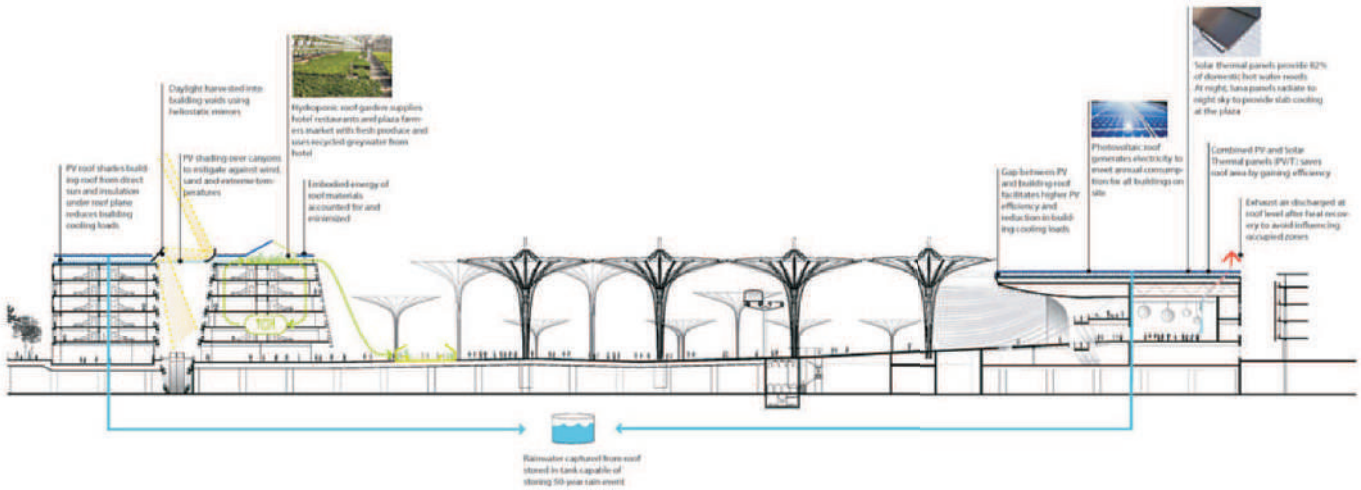
Masdar is a planned city located 17 kilometres from abu dhabi. a government initiative, the city is being constructed over seven phases and is due to be completed by 2016. Designed by the British architectural firm Foster + Partners, the city will rely entirely on solar energy and other renewable energy sources, with a sustainable, zero-carbon, zero-waste ecology.

The solar-powered 'sunflower' umbrellas capture the sun's rays during the day and fold at night, releasing the stored heat. They follow the direction of the sun so as to provide continuous shade during the day, and are suitable to any desert-type environment in the world,

Materials on wall surfaces respond to changing temperatures and contain minimal embedded energy.

The project is supported by the global conservation charity World Wide Fund for Nature and the sustainability group bioregional. In response to the project's commitment to zero carbon, zero waste and other environmentally friendly goals, WWF and BioRegional have endorsed Masdar City as an official One Planet Living Community.





Conclusion

To achieve environmental sustainability in the building sector, engineers and architects must be educated about environmental issuesduring their professional training. People have to foster environmental awareness, introduce students to environmental ethics, and developing their skills and knowledge-base in a more sustainable design.The current status of sustainable design in architecture is thatof an ethic rather than a science on a non-compulsion luxury basis. While a change of lifestyles and attitudes toward the local and global environments is important, the development of scientific knowledge-basesthat provide skills, techniques, and methods of implementingspecific environmental design goals is also necessary.

- By SWAPNIL CHAVAN, T. E. Mech

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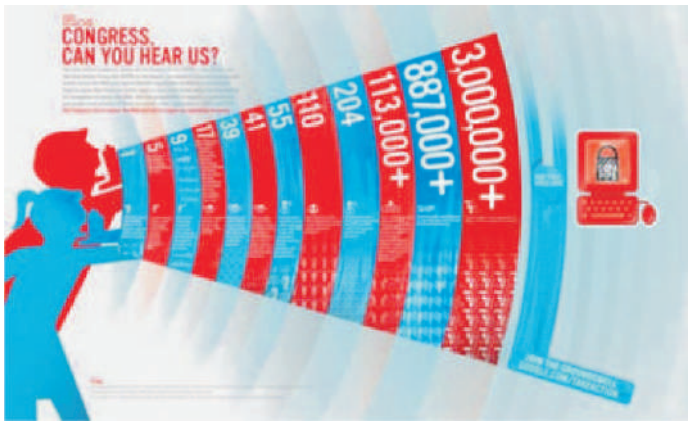
EDITORIAL DEBATE- SOPA

"The Administration and the Copyright Office have both called on Congress to amend the Copyright Act to ensure that illegal streaming to the public can be punished as a felony in the same manner as felony"



Remember SOPA? It was the bill introduced back in late 2011 that attempted to curb online copyright infringement; which, in turn, put the Internet into a frenzy. Websites like Wikipedia, Google and Reddit blacked out their pages to protest, and ultimately the bill failed (sigh of relief). other types of criminal infringement.

The Stop Online Piracy Act (SOPA) is a United States bill introduced by U.S. Representative Lamar S. Smith (R-TX) to expand the ability of U.S. law enforcement to combat online copyright infringement and online trafficking in counterfeit goods. Provisions include the requesting of court orders to bar advertising networks and payment facilities from conducting business with infringing websites, and search engines from linking to the websites, and court orders requiring Internet service providers to block access to the websites. The law would expand existing criminal laws to include unauthorized streaming of copyrighted content, imposing a maximum penalty of five years in prison.

Proponents of the legislation state it will protect the intellectual-property market and corresponding industry, jobs and revenue, and is necessary to bolster enforcement of copyright laws, especially against foreign-owned and operated websites. Opponents state the proposed legislation threatens free speech and innovation, and enables law enforcement to block access to entire internet domains due to infringing content posted on a single blog or webpage. Library associations have expressed concerns that the legislation's emphasis on stronger copyright enforcement would expose libraries to prosecution.

Against SOPA

On January 18, 2012, the English Wikipedia, Google, and an estimated 7,000 other smaller websites coordinated a service blackout, to raise awareness. Wikipedia claims more than 162 million people viewed its banner. Other protests against SOPA and PIPA included petition drives, with Google stating it collected over 7 million signatures, boycotts of companies and organizations that support the legislation, and an opposition rally held in New York City.

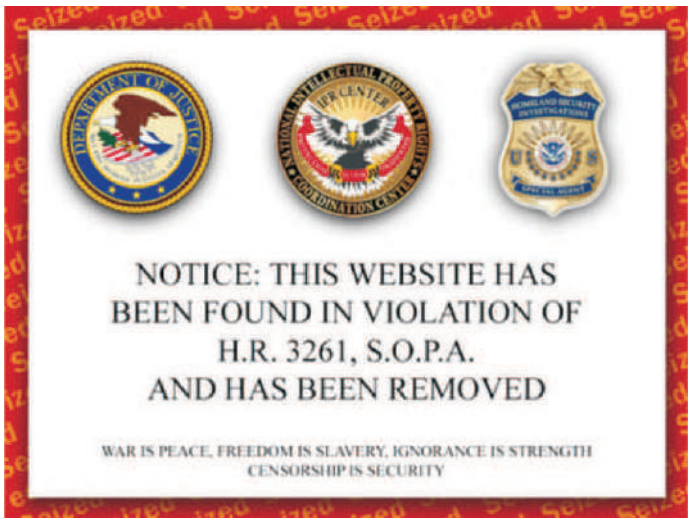
Wikipedia Blackout

The English Wikipedia blackout occurred for 24 hours on January 18–19, 2012. In place of articles, the site showed only a message in protest of SOPA and PIPA asking visitors to "Imagine a world without free knowledge.". It is estimated in excess of 160 million people saw the banner. A month earlier, Wikipedia co-founder Jimmy Wales initiated discussion with editors regarding a potential knowledge blackout, a protest inspired by a successful campaign by the Italian-language Wikipedia to block the Italian DDL intercettazioni bill, terms of which could have infringed the encyclopedia's editorial independence. Editors and others] mulled interrupting service for one or more days as in the Italian protest, or alternatively presenting site visitors with a blanked page directing them to further information before permitting them to complete searches. On January 16, the Wikimedia Foundation announced that the English-language Wikipedia would be blacked out for 24 hours on January 18.

The Daily Mail estimated that 7,000 smaller websites either joined in the blackout for the day or posted some kind of protest at the proposed legislation.

Favour Of Sopa

In response to the protest actions, the Recording Industry Association of America (RIAA) stated, "It's a dangerous and troubling development when the platforms that serve as gateways to information intentionally skew the facts to incite their users and arm them with misinformation",and "it's very difficult to counter the misinformation when the disseminators also own the platform.



Protecting Intellectual Property Of Content Creators

According to Rep. Goodlatte, "Intellectual property is one of America's chief job creators and competitive advantages in the global marketplace, yet American inventors, authors, and entrepreneurs have been forced to stand by and watch as their works are stolen by foreign infringers beyond the reach of current U.S. laws. This legislation will update the laws to ensure that the economic incentives our Framers enshrined in the Constitution over 220 years ago—to encourage new writings, research, products and services— remain effective in the 21st century's global marketplace, which will create more American jobs."

The Technical Hinderances Regarding SOPA

If SOPA comes into effect and a list of blocked websites has to be maintained by the internet service provider, then the operator will also have to monitor the internet traffic of each and every user. This not only raises issues of privacy but also opens a door for hackers to gain access to sensitive user data.

SOPA will, in essence, legitimise censorship, make it 'acceptable' or the 'right thing to do'. The US government will reserve the right to brand any website as illegal and cut off all support to it.This will hurt entrepreneurial online ventures, hurt jobs and several of your favourite websites may be gone forever too. Plus there will always be ways to get around censorship and those in the know will manage - just the regular users of the internet will be affected.

Viewpoints On SOPA

According to Markham Erickson, head of NetCoalition, which opposes SOPA, the section of the bill that would allow judges to order internet service providers to block access to infringing websites to customers located in the United States would also allow the checking of those customers' IP address, a method known as IP blocking. Erickson has expressed concerns that such an order might require those providers to engage in "deep packet inspection", which involves analyzing all of the content being transmitted to and from the user, raising new privacy concerns.

An analysis in the information technology magazine eWeek stated, "The language of SOPA is so broad, the rules so unconnected to the reality of Internet technology and the penalties so disconnected from the alleged crimes that this bill could effectively kill e-commerce or even normal Internet use. The bill also has grave implications for existing U.S., foreign and international laws and is sure to spend decades in court challenges."

Lukas Biewald, founder of CrowdFlower, stated, "It'll have a stifling effect on venture capital... No one would invest because of the legal liability

Booz & Company on November 16 published a Google-funded study finding that almost all of the 200 venture capitalists and angel investors interviewed would stop funding digital media intermediaries if the bill became law. More than 80 percent said they would rather invest in a risky, weak economy with the current laws than a strong economy with the proposed law in effect. If legal ambiguities were removed and good faith provisions in place, investing would increase by nearly 115 percent.

Wikipedia and many other internet organizations used their media power to feed internet users biased information to gain support for their highly politicized agenda.

CONCLUSION

Of course media companies are the ones behind these types of bills--they have the most money to use and the most money to lose. But artists everywhere that make any money off their work would benefit greatly from more REGULATION in the online world. Regulation, Clay, NOT censorship.

Before the internet, people shared things with each other in person (wild!), or even bought CDs for their friends. Not to pull a slippery slope fallacy out, but imagine when technology (such as 3D printers) becomes available to consumers and is able to copy more than digital creations... tools, machines, manufactured and patented inventions... would the desire to regulate that be simply labeled "censorship?"

SOPA vs PIPA vs OPEN

	#OPEN Act	#SOPA	PROTECT IP
	US House of Representatives & US Senate	US House of Representatives	US Senate
Protects the Rights of Artists	YES	YES	YES
Protects Against New Internet Police Powers	YES	NO	NO
Secures Safe Harbors for Legitimate Internet Businesses	YES	NO	NO
Protects Access to Social Media & Legitimate Websites	YES	NO	NO
Ensures Intellectual Property (IP) Cases Resolved By IP Experts	YES	NO	NO
Targets Actual Criminals: Foreign Rogue Websites	YES	NO	NO
Applies Due Process - Not Banks - To Judge Infringement Claims	YES	YES	YES
Supports Innovation & One of the Fastest Growing Industries in America	YES	NO	NO
Consistent with American Calls for Open Internet in Closed Societies	YES	NO	NO

SOURCES

All Images have been taken from the internet

The general viewpoints on SOPA were understood post browsing through various articles, newspaper columns and magazines.

- By RADHESH CHANDRAN, T. E. Mech

CANNON

It follows than as certain as that night succeeds the day, that without a decisive naval force we can do nothing definitive, and with it, everything honorable and glorious.
— George Washington

A **cannon** is any piece of artillery that uses gunpowder or other usually explosive-based propellants to launch a projectile. Cannon vary in caliber, range, mobility, rate of fire, angle of fire, and firepower; different forms of cannon combine and balance these attributes in varying degrees, depending on their intended use on the battlefield.

Cannon transformed naval warfare in the early modern period, as European navies took advantage of their firepower. As rifling became commonplace, the accuracy and destructive power of cannon was significantly increased, and they became deadlier than ever, both to infantry who belatedly had to adopt different tactics, and to ships, which had to be armored.

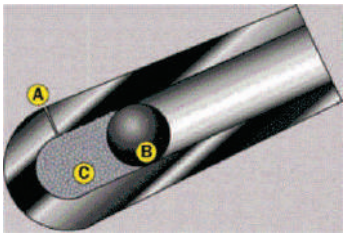
In World War I, the majority of combat fatalities were caused by artillery; they were also used widely in World War II. Most modern cannon are similar to those used in the Second World War, although the importance of the larger caliber weapons has declined with the development of missiles.

Any large, smoothbore, muzzle-loading gun—used before the advent of breech-loading, rifled guns—may be referred to as a cannon, though once standardized names were assigned to different sized cannons, the term specifically referred to a gun designed to fire a 42-pound (19 kg) shot, as opposed to a demi-cannon - 32 pounds (15 kg), culverin - 18 pounds (8.2 kg), or demi-culverin - 9 pounds (4.1 kg). *Gun* specifically refers to a type of cannon that fires projectiles at high speeds, and usually at relatively low angles; they have been used in warships, and as field artillery. The term *cannon* are also used for autocannon, a modern repeating weapon firing explosive projectiles. Cannon have been used extensively in fighter aircraft since World War II, and in place of machine guns on land vehicles.

CANNON MATERIALS, PARTS, AND TERMS

Essential parts of cannon:

1. Touch hole (or vent) in which the fuse or other ignition device is inserted
2. The projectile or cannonball
3. Gunpowder



BASIC CONSTRUCTION

Cannon in general have the form of a truncated cone with an internal cylindrical bore for holding an explosive charge and a projectile.

The thickest, strongest, and closed part of the cone is located near the explosive charge.

As any explosive charge will dissipate in all directions equally, the thickest portion of the cannon is useful for containing and directing this force.

The backward motion of the cannon as its projectile leaves the bore is termed its recoil and the effectiveness of the cannon can be measured in terms of how much this response can be diminished, though obviously diminishing recoil through increasing the overall mass of the cannon means decreased mobility

MATERIALS USED

The best cannon were cast in bronze, and were bored so that the stone, iron or lead cannonballs fit closely, without packing.

Earlier cannon had to use straw or cloth, or a wooden plug, to achieve a good fit.

Forged iron cannonballs with lead covering were used.

Only the smaller cannon used lead balls

Gun metal was 9 parts copper to one part tin, a different alloy than that used for bells.

Cast guns had a much better range than the earlier crude cannon, but were normally used at only slight elevation.

Cast iron was a much cheaper material than bronze, and when it became available, it was used not only for cannonballs, completely superseding stone by the end of the 16th century, but also for the cannon themselves.

However bronze has several characteristics that made it preferable as a construction material: although it is relatively expensive and does not always alloy well, bronze is more flexible than iron and therefore less prone to bursting when exposed to high pressure; cast iron cannon are less expensive and more durable generally than bronze and withstand being fired more times without deteriorating. However, cast iron cannon have a tendency to burst without having shown any previous weakness or wear, and this makes them more dangerous to operate.

If the casting was not very skillfully done, and the iron not free of phosphorus, cast-iron cannon tended to burst rather easily.

The French did not trust them, but the English made good ones.

Cannonballs could be either stone or metal.

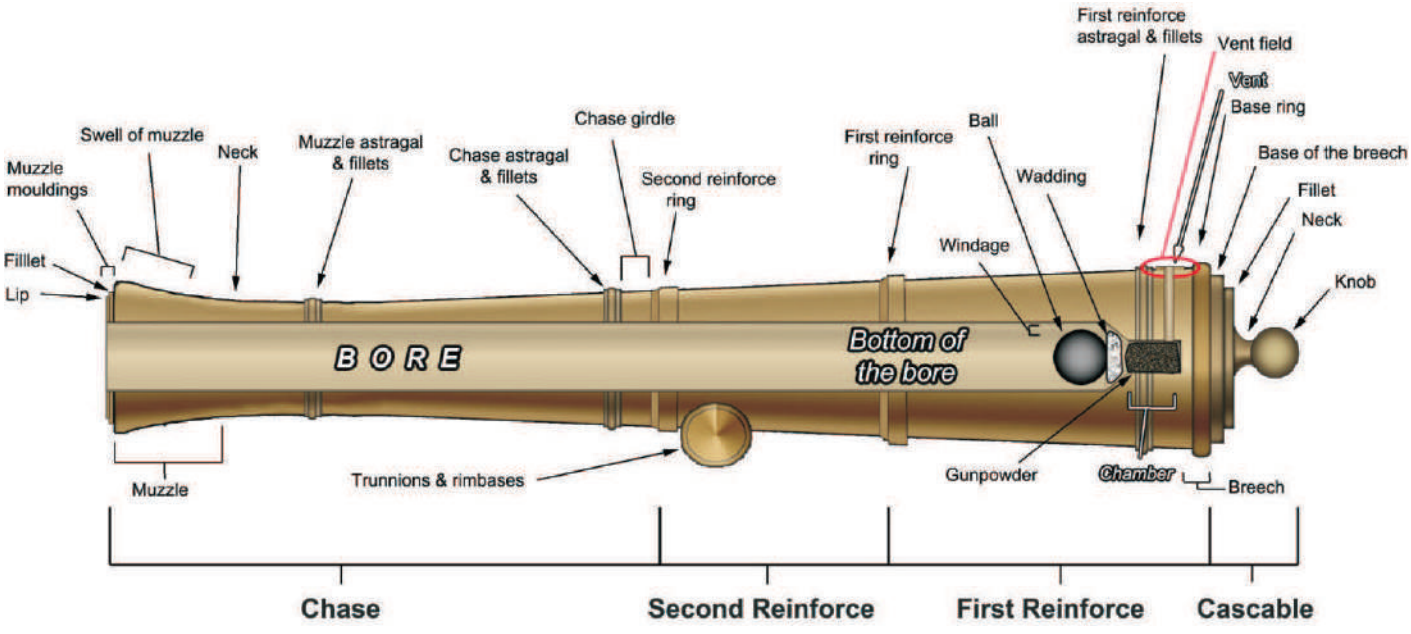
Field artillery cannon in Europe and the Americas were initially made most often of bronze, though later forms were constructed of cast iron and eventually steel.

TERMINOLOGY

The following terms refer to the components or aspects of classical western cannon as illustrated above. In what follows, the words *near*, *close*, and *behind* will refer to those parts towards the thick, closed end of the piece, and *far*, *front*, *in front of*, and *before* to the thinner, open end.

Negative spaces

- **Bore**: The hollow cylinder bored down the center of the cannon, including the *base of the bore* or *bottom of the bore*, the nearest end of the bore into which the ordnance (wadding, shot, etc.) gets packed. The diameter of the bore represents the cannon's caliber.
- **Chamber**: The cylindrical, conical, or spherical recess at the nearest end of the bottom of the bore into which the gunpowder is packed.
- **Vent**: A thin tube on the near end of the cannon connecting the explosive charge inside with an ignition source outside and often filled with a length of fuse; always located near the *breech*. Sometimes called the *fuse hole* or the *touch hole*. On the top of the vent on the outside of the cannon is a flat circular space called the *vent field* where the charge is lit. If the cannon are bronze, it will often have a *vent piece* made of copper screwed into the length of the vent.



Solid spaces

The main body of a cannon consists of three basic extensions—the foremost and the longest is called the *chase*, the middle portion is the *reinforce*, and the closest and briefest portion is the *cascabel* or *cascable*.

- **The chase:** Simply the entire conical part of the cannon in front of the *reinforce*. It is the longest portion of the cannon, and includes the following elements:
  - o The *neck*: the narrowest part of the chase, always located near the foremost end of the piece.
  - o The *muzzle*: the portion of the chase forward of the *neck*. It includes the following:
    - The *swell of the muzzle* refers to the slight swell in the diameter of the piece at the very end of the chase. It is often chamfered on the inside to make loading the cannon easier. In some guns, this element is replaced with a wide ring and is called a *muzzle band*.
    - The *face* is the flat vertical plane at the foremost edge of the muzzle (and of the entire piece).
    - The *muzzle moldings* are the tiered rings which connect the face with the rest of the muzzle, the first of which is called the *lip* and the second the *fillet*
    - The *muzzle astragal and fillets* are a series of three narrow rings running around the outside of the chase just behind the neck. Sometimes also collectively called the *chase ring*.
  - o The *chase astragal and fillets*: these are a second series of such rings located at the near end of the chase.
  - o The *chase girdle*: this is the brief length of the chase between the chase astragal and fillets and the *reinforce*.
- **The reinforce:** This portion of the piece is frequently divided into a *first reinforce* and a *second reinforce*, but in any case is marked as separate from the chase by the presence of a narrow circular *reinforce ring* or *band* at its foremost end. The span of the reinforce also includes the following:
  - o The *trunnions* are located at the foremost end of the reinforce just behind the reinforce ring. They consist of two cylinders perpendicular to the bore and below it which are used to mount the cannon on its carriage.
  - o The *rimbases* are short broad rings located at the union of the trunnions and the cannon which provide support to the carriage attachment.
  - o The *reinforce band* is only present if the cannon has two reinforces, and it divides the first reinforce from the second.
  - o The *breech* refers to the mass of solid metal behind the bottom of the bore extending to the *base of the breech* and including the *base ring*; it also generally refers to the end of the cannon opposite the *muzzle*, i.e., the location where the explosion of the gunpowder begins as opposed to the opening through which the pressurized gas escapes.
  - o The *base ring* forms a ring at the widest part of the entire cannon at the nearest end of the reinforce just before the *cascable*.
- The **cascable:** This is that portion of the cannon behind the reinforce(s) and behind the *base ring*. It includes the following:
  - o The *knob* which is the small spherical terminus of the piece;
  - o The *neck*, a short, narrow piece of metal holding out the knob; and
  - o The *fillet*, the tiered disk connecting the neck of the cascable to the *base of the breech*.
  - o The *base of the breech* is the metal disk that forms the most forward part of the cascable and rests against the breech itself, right next to the *base ring*.

WORKING

- To pack a muzzle-loading cannon, first gunpowder is poured down the bore.
- This is followed by a layer of wadding (often nothing more than paper), and then the cannon ball itself.
- A certain amount of windage allows the ball to fit down the bore, though the greater the windage the less efficient the propulsion of the ball when the gunpowder is ignited.
- To fire the cannon, the fuse located in the vent is lit, quickly burning down to the gunpowder, which then explodes violently, propelling wadding and ball down the bore and out of the muzzle.
- A small portion of exploding gas also escapes through the vent, but this does not dramatically affect the total force exerted on the ball.

CANNON INSTRUMENTS

Several instruments are used to service a medieval style cannon, as noted in the 1771 Encyclopedia Britannica.

- The **sponge** is a long staff or rammer with a piece of fleece sheep or lambskin wound about its end, to serve for scouring the cannon when discharged, before it is to be charged with fresh powder. This cleaning prevents any spark or fire from remaining in the piece, which would endanger the life of the loading crew. Sponges were the most commonly used cannon cleaning instruments.
- A **wad-screw** is two points of iron in the shape of a corkscrew, to extract the wad out of the piece. Used when the cannon has to be unloaded or dirt must be removed.
- The **lantern** or **ladle** serves to carry the powder into the piece. It consists of a wooden box appropriated to the caliber of the piece for which it is intended with a length of a caliber and a half with its vent, and of a piece of copper nailed to the box at the height of a half caliber. This lantern must have three calibers and a half in length, and two calibers in breadth, being rounded on the end to load the ordinary pieces[1]
- The **primer** must contain a pound of powder at least, and is used to prime the pieces.
- A **rammer** is a round piece of wood, commonly called a box, which serves to drive home the powder and ball to the breech. It is fastened to a stick twelve feet long, for the pieces from twelve to thirty-three pounders, and ten for the eight and four pounders.
- The **botefeux** is used to hold a winding of match with which to fire the cannon. May be a stick two or three feet long with a split to hold one end of the match.

- A **priming iron** is a pointed iron rod, used to clear the touch hole of the pieces of powder or dirt. Also used to pierce the cartridge, that it may sooner take fire.
- The **quoin of mire** are pieces of wood with a notch on the side to put the fingers on, to draw them back or push them forward, when the gunner points his pieces. They are placed on the sole of the carriage.

Leaden plates are used to cover the touch-hole, when the piece is charged, to keep dirt from entering the touch-hole.

•

CANNON PROJECTILES

Round shot or **solid shot** or a **cannonball** or simply **ball**

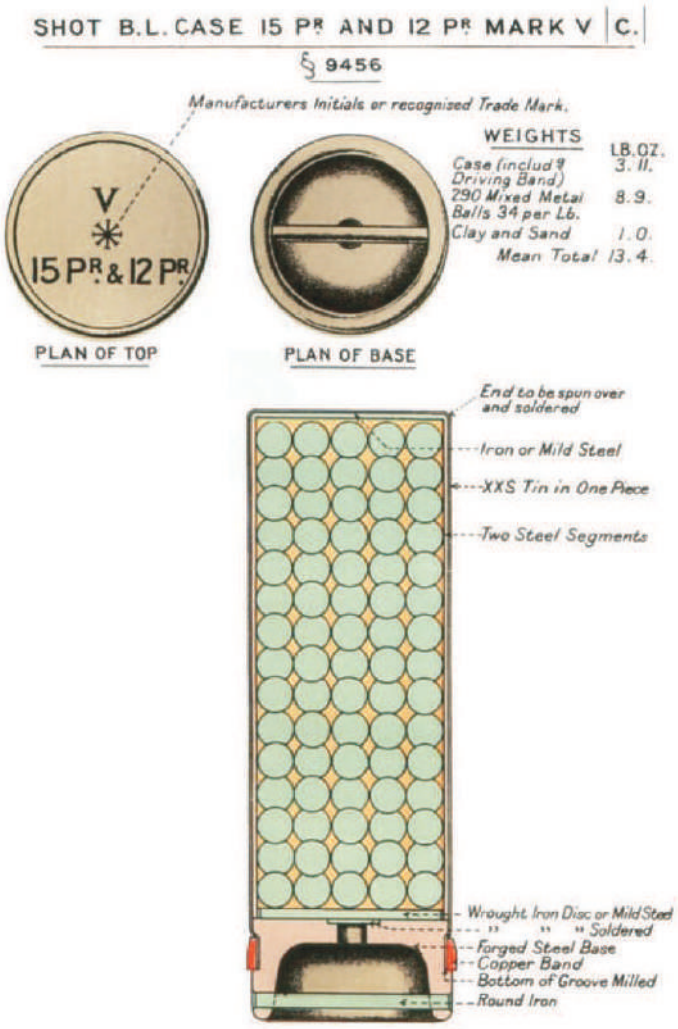
A solid spherical projectile. The most accurate projectile that could be fired by a smooth-bore cannon, used to batter the wooden hulls of opposing ships, forts, or fixed emplacements, and as a long-range anti-personnel weapon.

Chain shot or **Split shot**

Two sub-caliber round shot (a good deal smaller than the bore of the barrel) linked by a length of chain or a solid bar, and used to slash through the rigging and sails of an enemy ship so that it could no longer maneuver. It was inaccurate and only used at close range. **Two-headed bullets (angels)** were similar but made of two halves of a ball rather than two balls.

Canister shot

An anti-personnel projectile which included many small iron round shot or lead musket balls in a metal can, which broke up when fired, scattering the shot throughout the enemy personnel, like a large shotgun.



Shrapnel or spherical case shot

An iron anti-personnel projectile containing an interior cavity packed with lead or iron round balls around a small bursting charge of just enough force to break open the thin-walled iron projectile. A powder train in a thin iron sleeve led to a time fuse inserted into a holder at the outer edge or the projectile. The fuse was designed to be ignited by flame from the propellant charge. Ideally the case shot fuse would detonate the central bursting charge when the projectile was six to ten feet above the heads of enemy infantry thereby showering them with the iron balls and fragments of the casing.

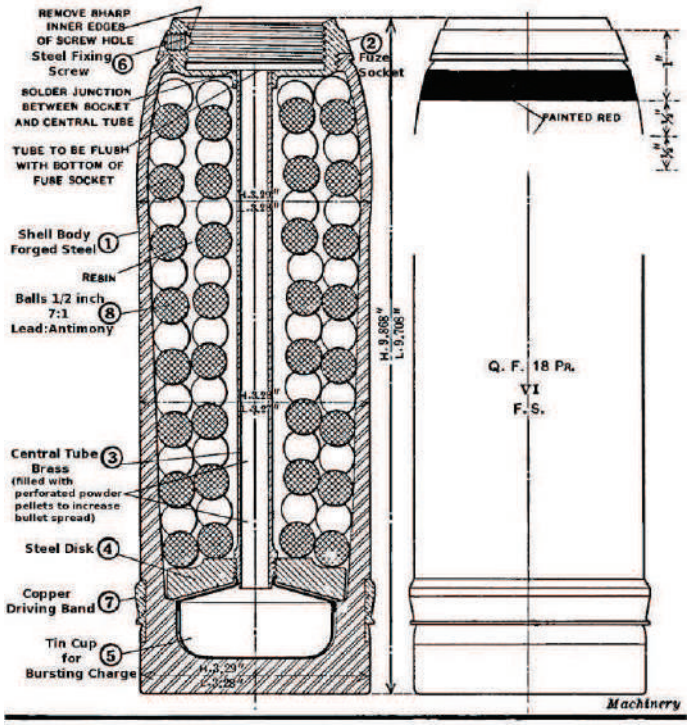
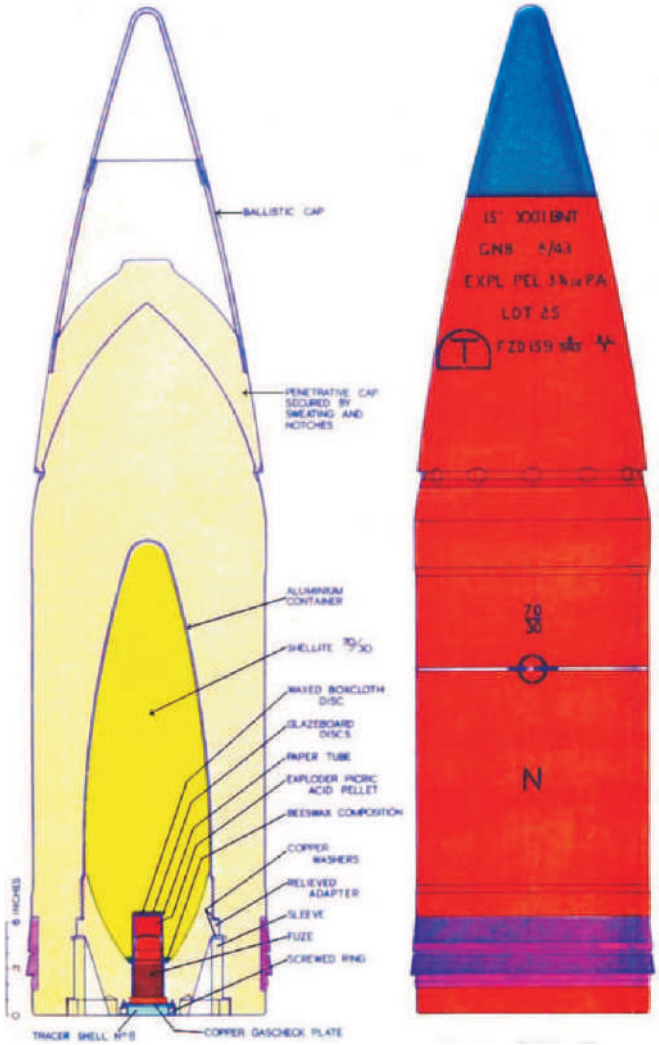


Fig. 1. Construction of British 18-pounder Quick-firing Shrapnel Shell

Shell

An explosive anti-material and counter-battery projectile, of iron with a cavity packed with a high explosive bursting charge of powder used to destroy enemy wagons, breastworks, or opposing artillery. Two types of fuses were used—impact fuses that detonated the bursting charge by percussion and time fuse cut to length measured in seconds and ignited by flame from the propellant charge.



Grapeshot

An anti-personnel weapon with the shot being contained in a canvas bag and generally of a larger caliber. It was very effective against infantry, but its main shortcomings included very short range and ineffectiveness against infantry who had taken cover.

Carcass

An incendiary/antipersonnel projectile designed to burn fiercely and produce poisonous fumes. It was constructed of an iron frame bound with sack cloth and filled with various ingredients such as pitch, antimony, sulfur, saltpeter, tallow and venetian turpentine. It was ignited by the cannon's propellant charge, bursting on impact with the target and releasing noxious fumes while setting fire to its surroundings. It was effectively an early chemical weapon as well as an incendiary and area denial weapon. The name is possibly a reference to the medieval practice of hurling dead animals from trebuchet as a form of biological warfare, or to the projectile's superficial resemblance to a human carcass.

Heated (or hot) shot

A process where a solid iron cannonball is heated red hot in a specially-designed wood- or coal-fired furnace and then is loaded in a muzzle-loading cannon, cushioned by a substantial thickness of wet wads, and is then fired while still red hot, at flammable targets with the intention of setting them on fire.

Spider Shot

Spider shot is a chain shot, but it has many chains instead of just one. It was not often used, despite its effectiveness against small ships and morale.

- By AKHILESH SINGH, T. E. Mech

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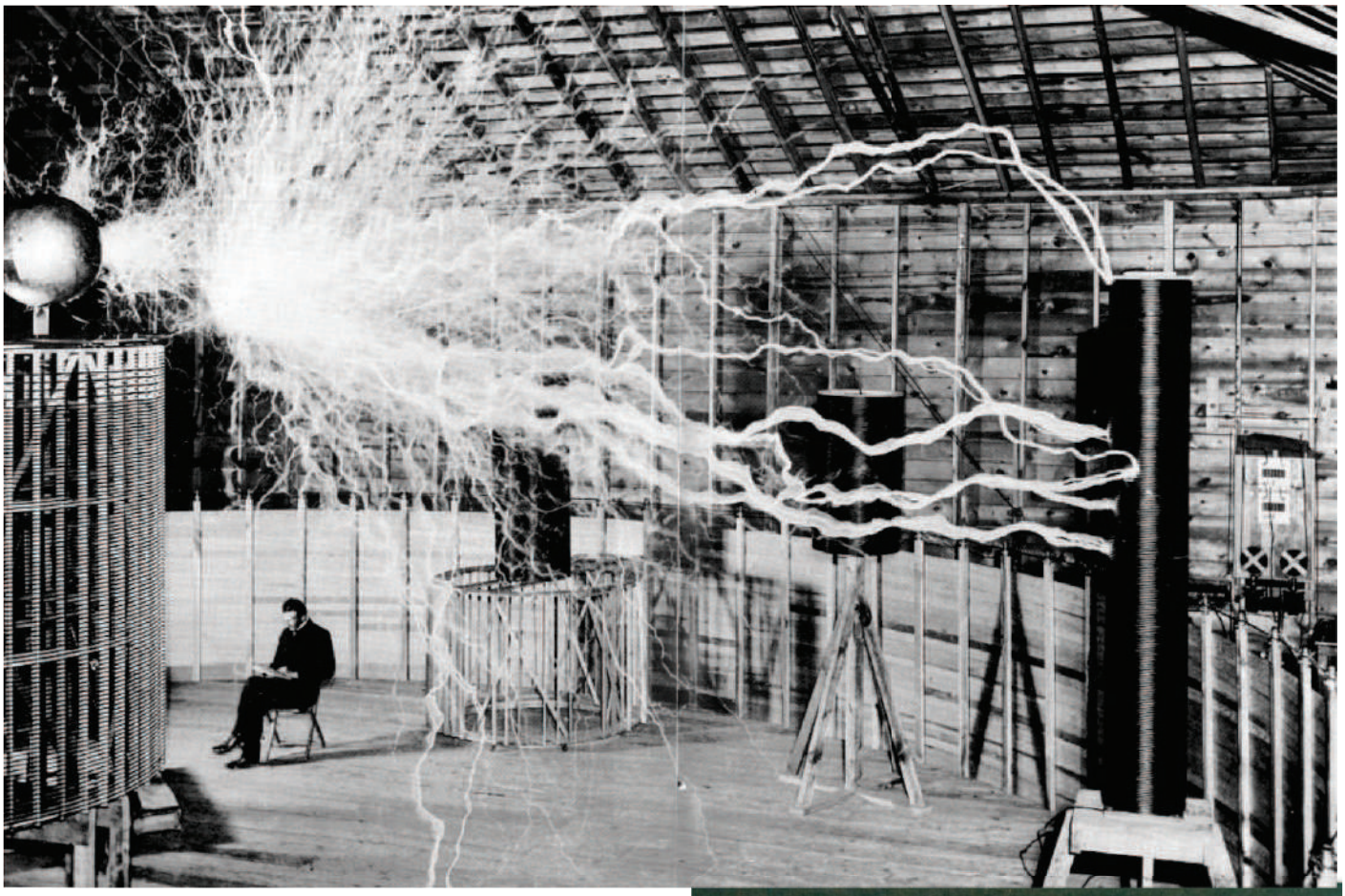
THE TESLA CONS "PIRACY"



When you come across the word "scientist" the first few names that strike you obviously are Albert Einstein, Sir Isaac Newton, Aristotle…there is much consternation about the greatest geek the world has ever witnessed.

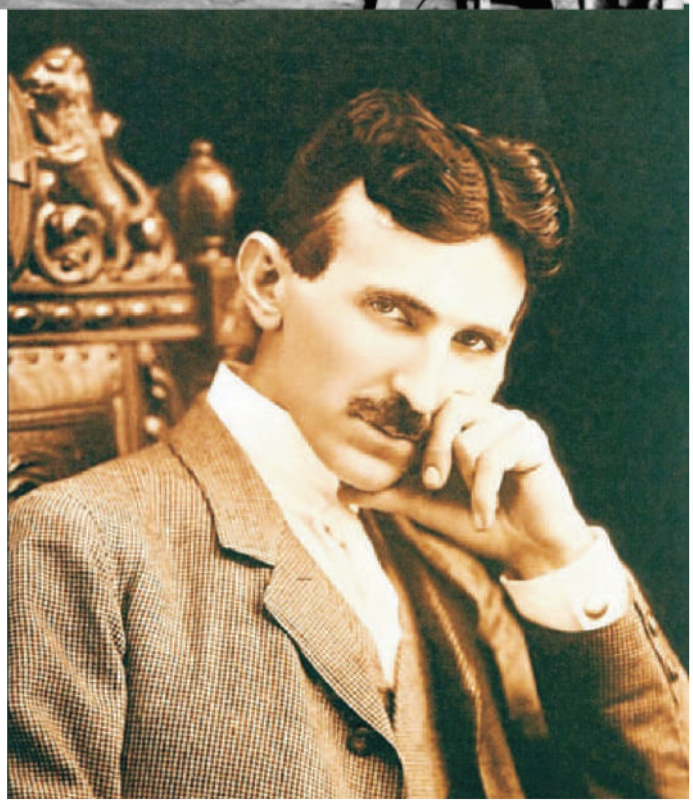
This article is to educate you on why Nikola Tesla was the greatest geek who ever lived. That's right a name you barely have come across was a person who spoke eight different languages and could memorize a whole book and recite it at will, was the mastermind behind almost every modern day electrical devices which are used today.

Over one hundred years ago a Serbian-American inventor by the name Nikola Tesla started fixing things that weren't broken. At the time when majority of the world was lit up by candles an electrical system known to us as the alternating current was invented by him and to this day is what powers each home on this planet. So what is the conspiracy in it?

When most people think of Thomas Edison (the supposed father of electrical age), they think of the man who invented the light bulb. Well Edison did not invent it he improvised the idea of light bulb given by Nikola Tesla.

Ever heard of a person by the name Marconi? He won a noble prize for inventing the radio. Did you know whatever he did was based on work previously done by Tesla?

Ever heard of radar, the awesome technology that lets us detect missiles and torpedoes from far away? An English scientist Robert A. Watson Watt was accredited with its invention in 1935. Can you



guess who came up with its idea in 1917? You got it right, Tesla.

Wilhelm Roentgen is typically credited as the discoverer of x rays but it was Nikola Tesla who beat him to it and also warned that x rays could be dangerous and refused to use it for medical experiments while it was believed to cure blindness and other ailment

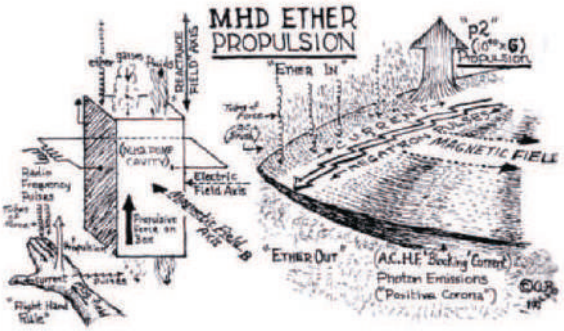
Tesla also built the first hydroelectric plant at Niagara Falls and proved to the world that this type of power was a practical energy source

Various other firsts that Nikola Tesla held:

- First person to record radio waves from outer world
- Discovered the resonant frequency of earth
- Invented remote control
- Neon lighting
- Modern electric motor
- Wireless communication

The occult ether theory and electro propulsion

Ether is an all-pervading, infinitely elastic, mass less medium formerly postulated as the medium of propagation of electromagnetic waves.



The element believed in ancient and medieval civilizations to fill all space above the sphere of the moon and to compose the stars and planets.

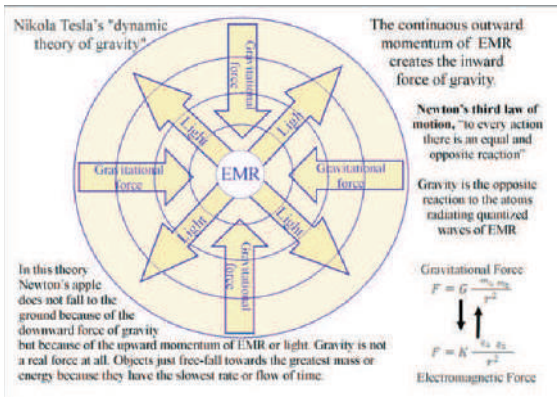
Tesla's ether was neither the "solid" ether with the "tenuity of steel", nor the half-hearted, entrained, gaseous ether. Tesla's ether consisted of "carriers immersed in an insulating fluid", which filled all space. Its properties varied according to relative movement, the presence of mass, and the electric and magnetic environment.

Tesla's ether was rigidified by rapidly varying electrostatic forces, and was thereby involved in gravitational effects, inertia, and momentum, especially in the space near earth, since, as explained by Tesla, the earth is "...like a charged metal ball moving through space", which creates the enormous, rapidly varying electrostatic forces which diminish in intensity with the square of the distance from earth, just like gravity.

Tesla's theories are further reducible to the following four statements pertinent to electro-propulsion technology:

1. Mechanical motions can be produced by varying electrostatic force acting through a gaseous (ether) medium, which thereby becomes rigidified, yet allows solid bodies to pass through.
2. Under influence of stress in one direction (under the polarizing influence of light or heat), the carriers may group together, forming tubes of force, creating greater ease of movement in that direction.
3. When a (DC) brush is created by a steady potential, a continuous exchange of carriers is created corresponding to ether rarefaction, as the tubes of force are drawn into the conductor.
4. With a sufficiently high frequency and stress intensity in the opposite direction, carrier exchange is blocked by ether compression, forcing the tubes of force to dissolve in the conductors of the ship, imparting electromagnetic momentum.

Tesla outlined his dynamic theory of gravity in poetic form:



- That the luminiferous ether fills all space
- That the ether is acted upon by the life-giving creative force
- That the ether is thrown into "infinitesimal whirls" ("micro helices") at near the speed of light, becoming ponder able matter
- That when the force subsides and motion ceases, matter reverts to the ether (a form of "atomic decay")
- That man can harness these processes, to:
  - o Precipitate matter from the ether
  - o Create whatever he wants with the matter and energy derived
  - o Alter the earth's size
  - o Control earth's seasons (weather control)
  - o Guide earth's path through the universe, like a space ship
  - o Cause the collisions of planets to produce new suns and stars, heat, and light
  - o Originate and develop life in infinite forms

Tesla was referring to unlimited energy, derived from the environment. Several of his major free energy discoveries have been the exclusive stolen property of our secret government. The conversion of energy to a stronger force—electro propulsion—used to control the much weaker gravity force, would accomplish more work in the same amount of time, and produce "over unity" results.

Tesla's contribution to modern day science is not just incremental but ARE REVOLUTIONARY

- By G. M. SREERAM, T. E. Mech

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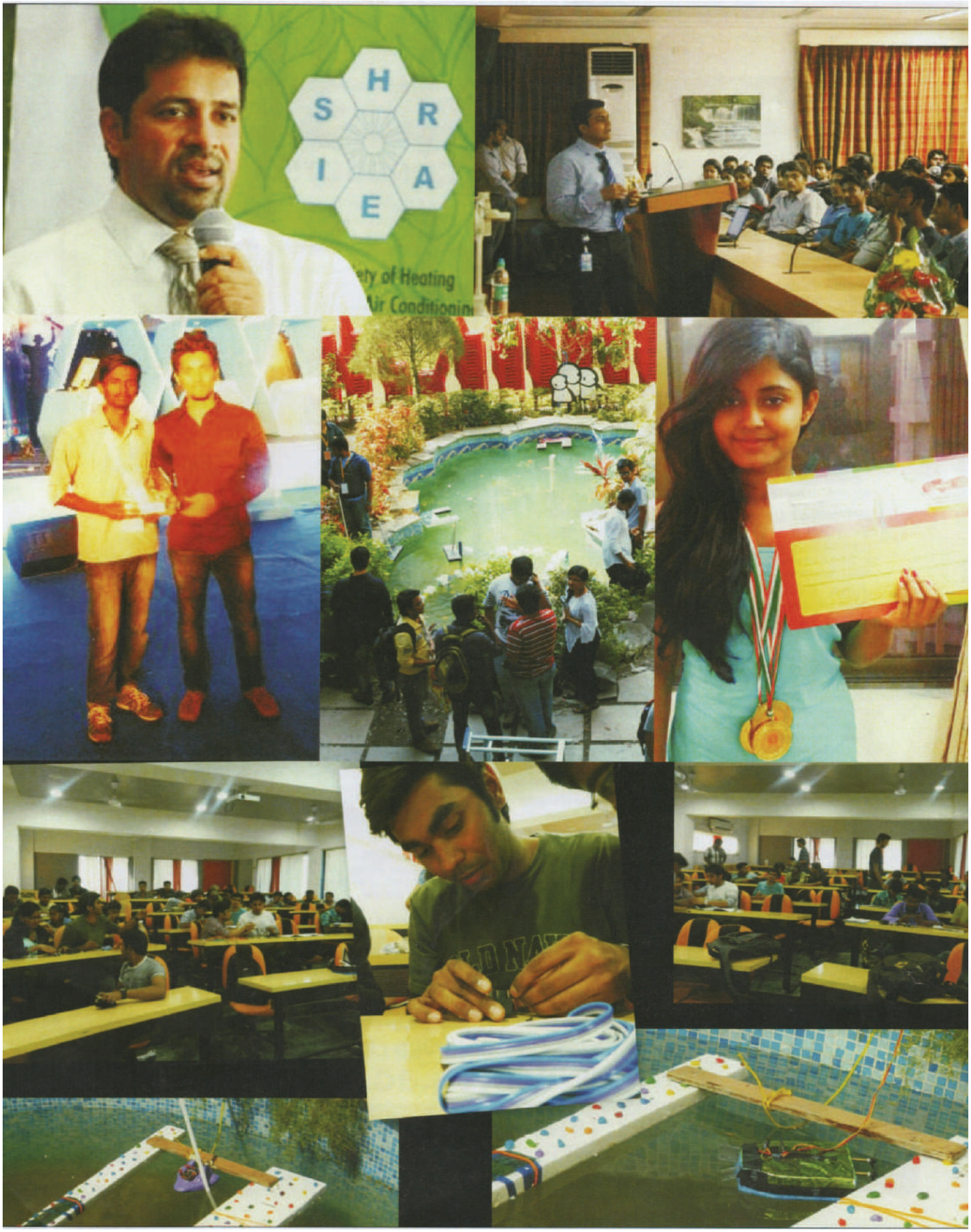
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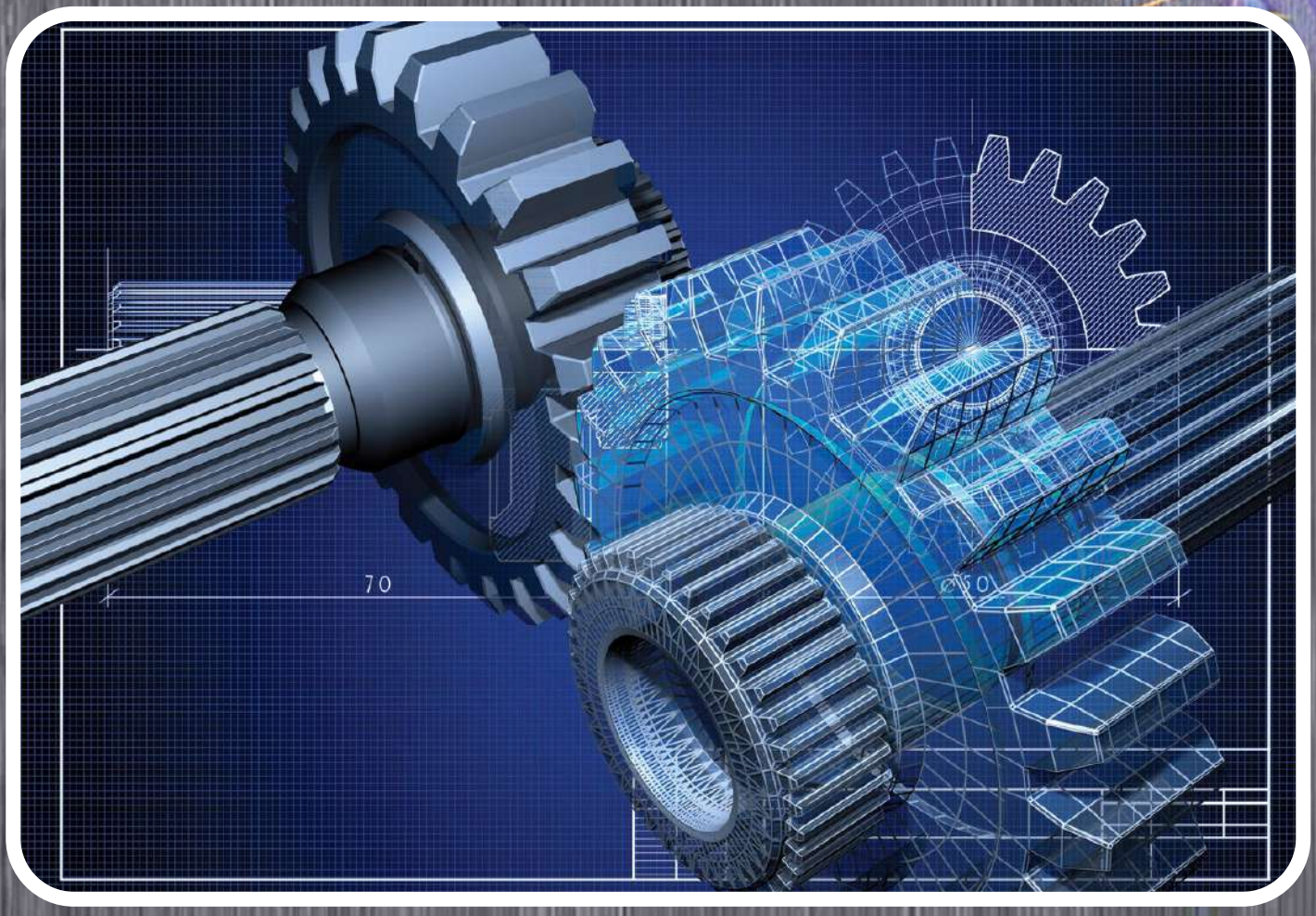

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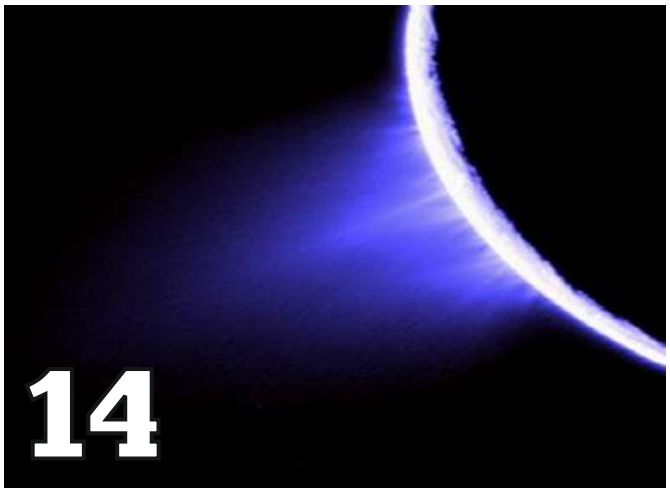

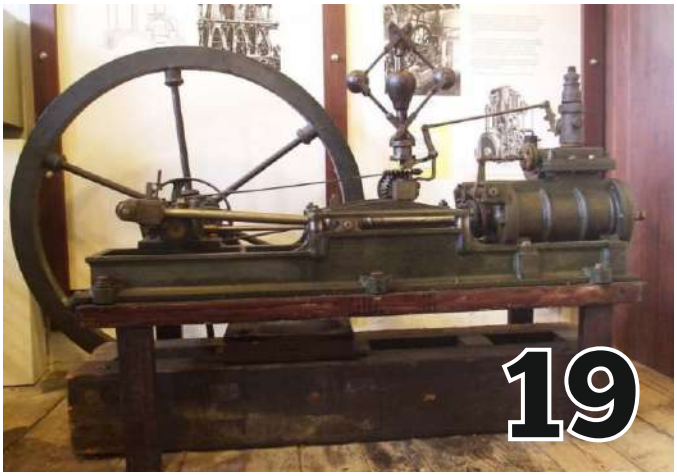

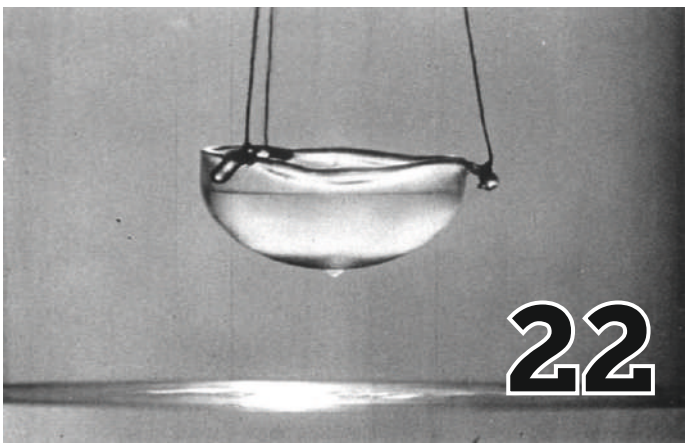

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Brake Energy Recovery System on a Bicycle using a Flywheel

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Abstract : Kinetic Energy Recovery System (KERS) as the name suggests deployed to recover the kinetic energy lost during Braking. We plan to implement a Mechanical KER System in a Bicycle equipped with a Flywheel to store the energy during Braking and release it to help propel the rider when re-starting. The rider can charge the KERS (Flywheel) when slowing down or going down the hill and boost the Bicycle performance during accelerating or going up the hill.

Index Terms— Kinetic Energy Recovery System (KERS), Flywheel Energy Storage (FES)

I. INTRODUCTION

A flywheel is an energy storage device that uses its significant moment of inertia to store energy by rotating. Flywheels have long been used to generate or maintain power and are most identified with the industrial age and the steam engine. In one sense it can be thought of as a rechargeable battery that store energy in the form of mechanical energy instead of electrochemical. Flywheels have been gaining popularity as a possible replacement for chemical batteries in vehicles, but until last year there was no record of a flywheels being used to increase the efficiency of a bicycle.

II. MOTIVATION

In 2011, Maxwell von Stein, a student at Cooper Union, added a flywheel and a continuously variable transmission to his bike for his senior project.1 He used a car flywheel he found that weighs 15 pounds. His idea won him the Nicholas Stefano Prize, which is Cooper Union's award for superior mechanical engineering design. He also gained quite a bit of notoriety on various biking websites and was featured in NPR's weekly segment, “Science Friday.”2 This idea of adding a flywheel to a bicycle is very appealing because it can increase the efficiency of what is already considered a very efficient machine. The only concern with Mr. von Stein's design is that his flywheel is very heavy. It was made for a car, so an extra 15 pounds would hardly be significant in such a heavy vehicle. However, when 15 pounds are added to a bike it makes a significant difference in the additional work it takes to accelerate the bike. Mr. von Stein estimated that the additional weight adds about ten percent more weight to the system, and he also estimated the peak efficiency gain from his flywheel is ten percent. This means at its peak, the flywheel is only making up for the efficiency lost by its additional weight. If the flywheel was optimized for the different design requirements of a bike, it could increase the efficiency of a bike in more significantly.

As the world looks for ways to shift its dependence from fossil fuels to power its automobiles many new forms of energy have come up including electric cars, solar cars etc. And to that list we would like to add one more: The KERS Bicycle.

The dependence of the world's population cars is one which can almost never be replaced and of that too replacing it with a bicycle is almost suicidal. But facts cannot be ignored and one day we will need to get rid of cars and find another fast way to get around. So at that point taking out your old bicycle and giving it a ride does not seem to be that bad an idea after all.

But recent trends are showing good signs of change. In today's health conscious world people are always ready to go for a good workout and these bicycles could provide as good a workout as anything else.

Using this project we aim to provide a new class of bicycles inculcated with a new technology that would decrease the physical strain experienced by bike riders over large distances as well as bring back the joy of bike riding that was present in the past and could change the future as well

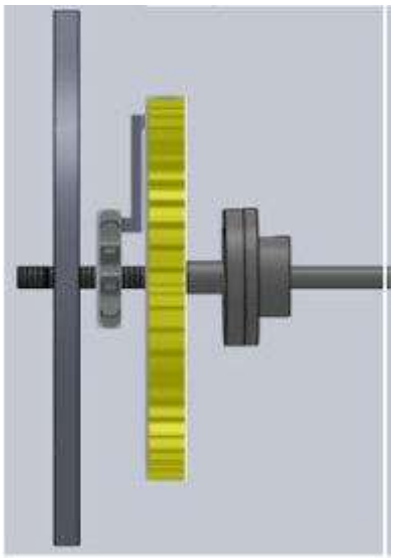
IV.PRINCIPLES

In this project we aim to introduce three main principles:

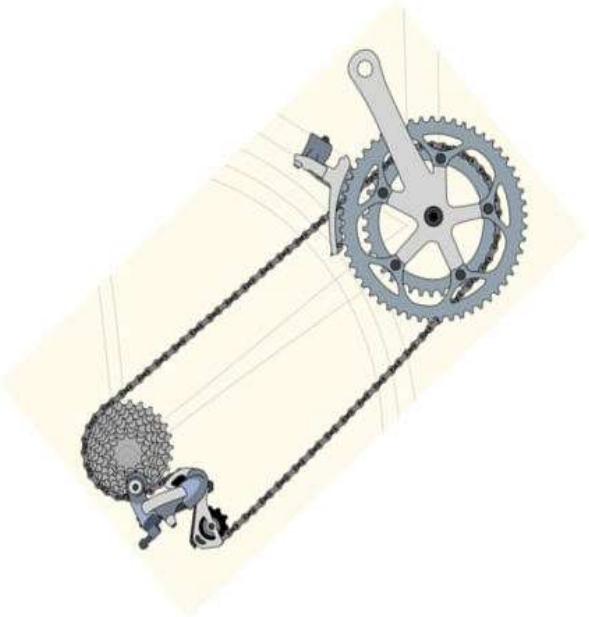
- **KERS (Flywheel Technology):** As stated in the first page the normal KERS technology uses a generator-motor to convert electrical energy and the energy is stored in a batten.-. In this purely mechanical version of the KERS technology this function is performed by a flywheel. A flywheel is a rotating mechanical device that is used to store rotational energy. Flywheels have a significant moment of inertia and thus resist changes in rotational speed. The amount of energy stored in a flywheel is proportional to the square of its rotational speed. Energy is transferred to a flywheel by applying torque to it. There by-increasing its rotational speed, and hence its stored energy. Conversely, a flywheel releases stored energy by applying torque to a mechanical load, thereby decreasing its rotational speed. The flywheel is constructed such that the diameter is large and the majority of the mass is concentrated along the outer ends so as to maximize the moment of inertia. In this bicycle the flywheel gains energy and discharges energy though the rear wheel of the bicycle.

- **Q Ring**: We have all grown up pedaling the traditional circular chain ring in our bicycles but latest technology is all set to replace this traditional bicycle heirloom with the introduction of Q rings. Instead of the conventional circular shapes these chain rings are oval shaped and help to increase the power generation, decrease the fatigue and provide an overall faster and smoother ride. Rotor Q-Rings do not eliminate the dead-spot (as do Rotor Cranks) but help to reduce its negative effects, moving the legs easier through the dead spot imitating a smaller circular chain ring, and enabling the legs to remain in the power stroke for a longer period of time when compared to round chain rings. In the beginning of a pedaling cycle the diameter of the chain ring is minimum and hence less torque is required to enter the pedal cycle. As the pedal cycle enters the maximum torque stage the larger diameter side occurs and hence it is easier to pedal through that portion.

- **Mechanism:** This is a mechanism used to link the flywheel system and the rear wheel system whenever required. During normal pedaling flywheel should be at rest and while breaking this link should be severed beforehand so as to allow the flywheel to retain the rotational energy while the rear wheel will be slowed down due to the



- **Gear System:** This system contains three sprockets. Two sprockets i.e one with maximum number of teeth and other one with minimum number of teeth is placed on rear wheel and sprocket with more number teeth than maximum one and less number of teeth than minimum one is placed on flywheel. And gear ratio is maintained to avoid sleeping of chain.a



V. WORKING

The working can be explained stage by stage:

- **Stage 1:** Starting from rest as we start pedaling. Initially the flywheel and the rear wheel are not connected. When we start pedaling the Q rings aid the pedaling and greater force is transferred to the rear wheels.·
- **Stage 2:** Reaching optimum speed**.** By optimum we are referring to a normal cycling speed. So the rear wheel now rotates at a very high speed.
- **Stage 3:** Application of brakes Now we are reaching a turn or bend, hence it is necessary to decrease the speed before taking the turn. So initially we need to connect the flywheel to the rear wheel. Now flywheel starts gaining speed and hence it is getting charged. The chain ring present on the rear wheel is of greater diameter than that present alongside the flywheel. Hence proportional to the rear wheel greater rotation is being transferred to the flywheel .After absorbing the Energy, flywheel is disconnected from rear wheel and the brakes are applied and the

applied and the rotational speed of the rear wheel is decreased. But at the same time, the braking has not affected the flywheel and its high moment of inertia enables it to continue on rotating with minimal decrease in rotational energy.

- Stage 4: Recovering lost speed: The KERS System. After the turn has been encountered, the rear wheel now rotates at a lower speed than the flywheel. Now if the control mechanism is engaged to reconnect the flywheel and the rear wheel the KERS system will spring into action. The speed of the flywheel will be proportionally decreased and that of the rear wheel proportionally increased until a common speed is reached. So the rider of the bike experiences a rise in speed of the bike without him actually doing any work.
- Stage 5: Cycle begins again. Now we are back to stage 1 and the whole cycle begins anew. In this way energy which would otherwise have been simply wasted during braking can now be converted to useful energy available to the rider hence decreasing the physical strain imposed on him her.
-

VI. FUTURE DEVELOPMENTS

As technology keeps on advancing new developments to this cycle can be made. Here we take a look at some possible future developments**:**

- **Electro Magnetic Suspension**: A defect with the existing model lies in the losses that the flywheel will endure in the form of friction and other mechanical losses. A useful technology for counteracting these losses is the electromagnetic suspension of the flywheel. If the flywheel can be magnetically suspended about the connecting rod then all the mechanical losses can be averted leading to almost idealistic energy transfer between the flywheel and the rear wheel
- ·**Efficient Gear Mechanism:** A single chain linkage between the flywheel and the rear wheel comprising of the same two gears is not very efficient for riding the bicycle across different terrains. For flat terrains a larger diameter Chain Ring connected to the flywheel while a smaller diameter chain ring to the rear wheel is advisable for faster rotation of the rear wheel. While in the case of terrains with an upward gradient like mountainous paths the opposite chain ring allocation with respect to the above is preferred

- **Flywheel Rotor - Reluctance Motor:** Rotor flywheel mass could work as a Reluctance motor in contrast to common mechanical flywheel. Flywheel energy storage subunit will consist of stator, incl. stator windings and channel for coolant back flow. Further we could see flywheel rotor equipped with Hybrid-Bearing. Hybrid-Bearing is combination of hydrodynamic and ball bearing, works in dependence on RPM. Ball bearing acts during starting acceleration from low speed. Hydrodynamic bearing starts working contact less at high revolutions.

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Compressed Air Engine

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Abstract : This paper presents an experimental investigation of piston engine driven by compressed air. In today's world, there has been a tremendous increase in energy and fuel crisis. As a solution for this problem, compressed air engine can be used as an alternative solution. Compressed air engine is powered by compressed air, which is stored in a tank. Instead of mixing fuel with air, and burning it in engine, to drive piston, with hot expanding gases, compressed air vehicles use the pressure energy of the compressed air to drive their pistons. Much like electrical vehicles, air powered vehicles would ultimately be powered through the electrical grid for refueling which makes it easier to focus on reducing pollution, as opposed to the millions of vehicles on road.
Keywords—compressed air engine; power performance; pressure; temperature; solenoid; piston; cylinder; compressed air storage tank, reed switch, magnet.

I. INTRODUCTION

Fossil fuels which meet most of the worlds energy demand today are being depleted rapidly. Also, their combustion products are causing global problems such as green house effect, ozone layer depletion, acid rains and pollution which are posing great danger for environment and eventually for the whole life on earth. These factors are leading automobile manufacturers to develop cars fueled by alternative energies.

One possible alternative is the air powered car. Air which is abundantly available and is free from pollution can be compressed to a higher pressure at a very low cost, is one of the prime option since atmospheric pollution can be permanently eradicated. The Compressed air engine is a pneumatic actuator that creates useful work by expanding compressed air. A compressed air vehicle is powered by an air engine, using compressed air, which is stored in a tank.

The law of physics dictates that uncontained gases will fill any given space. The easiest way to see this in action is to inflate a balloon. The elastic skin of the balloon holds the air tightly inside, but the moment you use a pin to create a hole in the balloon's surface, the air expands outward with so much energy that the balloon explodes. Compressing a gas into a small space is a way to store energy. When the gas expands again, the energy is released to do work. That's the basic principle behind what makes an air-car run.

II. OBJECTIVES

Compressed-air technology reduces the cost of vehicle production by about 20%, because there is no need to build a cooling system, fuel tank, Ignition Systems or silencers. Low manufacture and maintenance costs as well as easy maintenance are possible. The engine

easy maintenance are possible. The engine can be massively reduced in size and weight. The engine runs on cold or warm air, so can be made of lower strength light weight material such as aluminum, plastic, low friction Teflon or a combination. Lighter vehicles cause less damage to roads, resulting in lower maintenance cost. Compressed-air tanks can be disposed of or recycled with less pollution than batteries. Much like electrical vehicles, air powered vehicles would ultimately be powered through the electrical grid. This makes it easier to focus on reducing pollution from one source, as opposed to the millions of vehicles on the road. Pollution created during fuel transportation would be eliminated. The air tank may be refilled more often and in less time than batteries can be recharged, with re-filling rates comparable to liquid fuels. The price of filling air powered vehicles is significantly cheaper than petrol, diesel or bio-fuel.

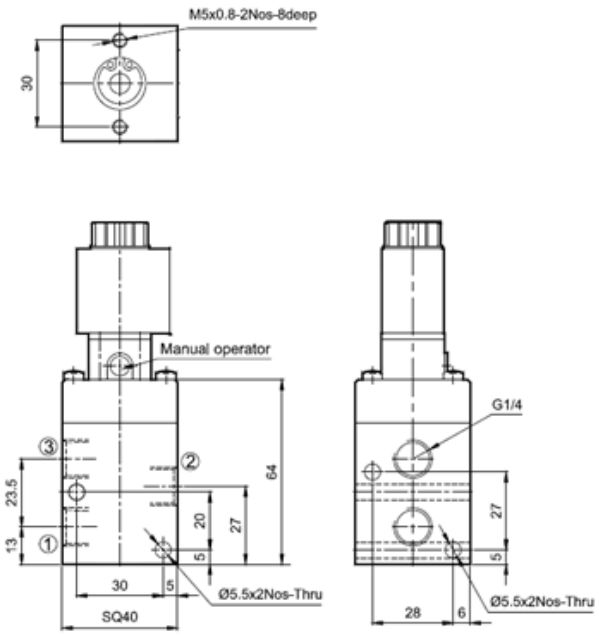
Compressed-air vehicles are unconstrained by the degradation problems associated with current battery systems in Electric vehicles.

III. MODIFICATIONS IN THE ENGINE

The project uses a two stroke, 145cc, petrol engine of Bajaj Chetak Scooter.

The unwanted parts of the engine include the Carburetor, Magneto ignition system, Spark plug, cooling fan and exhaust pipe.

The spark plug is replaced by a 3/2 NC Spring return Solenoid valve which is operated by reed switch. The reed switch is actuated by magnet which is placed such that it operate the solenoid valve to open when the pisto reaches the TDC (Top Dead Center). Th magnet is placed on the disc which is directl attached to the crankshaft such that its speed synchronous with the piston.Port 1 (Inlet) the solenoid valve is connected to the outlet the compressed air storage tank and the port 2



1 - Inlet, 2 - Outlet, 3 - Exhaust

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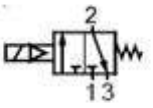
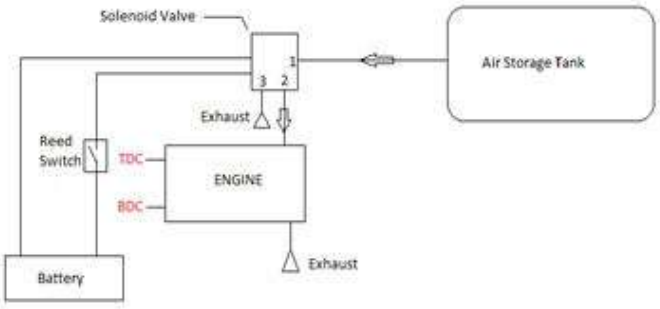
Symbol	

(Outlet) is attached to the engine at the position of the spark plug. The electrical energy needed to operate the solenoid valve is obtained from a 12-Volt DC battery.

IV. PROCESS DESCRIPTION

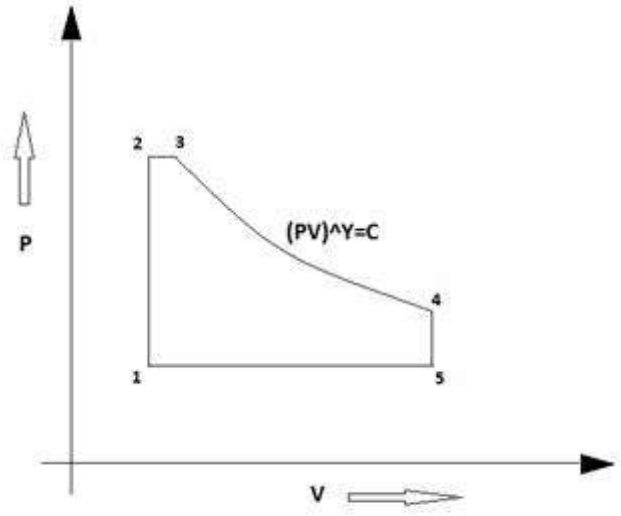
The following figure shows the schematic representation of the Compressed-Air Engine:



SCHEMATIC REPRESENTATION

When the piston reaches the TDC the reed switch is actuated by the magnet, operating the solenoid valve. At this stage, port 1 is connected to port 2 and thus the solenoid valve is opened which allows the compressed air to enter into the cylinder. The compressed air is forced in a very small area above the piston head which causes a considerable increase in the pressure thus forcing the piston to travel down to the BDC. As soon as the piston leaves TDC the reed switch cuts off the electrical connection to the solenoid valve and the valve closes. At this stage, port 3 is connected to port 2 and thus when piston travels from BDC to TDC, the air is exhausted to port 3. This cycle keeps repeating.

V. PROCESS CYCLES



P-V Diagram

Process 1-2(Constant Volume Process): When the solenoid valve opens the air is forced into a very small volume (clearance volume) and thus the pressure rises suddenly. This applies a large amount of force on the piston head forcing the piston to move down. The volume remains almost constant during this process..... (Temperature and entropy)

Process 2-3(Constant Pressure Process): After process 1-2 the piston starts moving down with increase in volume at constant pressure till the Solenoid valve remains open.

Process 3-4 (Reversible Adiabatic Process): When the solenoid valve closes the air supply is cut off and after the process 2-3 the air in the cylinder keeps on expanding adiabatically. Hence pressure decreases and volume increases as the piston reaches BDC.

Process 4-5(Constant Volume Process): Once the piston has reached BDC the exhaust valve of the engine gets opened and for a very short period exhaustion of air takes place at constant volume.

Process 5-6(Constant Pressure Process): In this process the piston stars moving from BDC to TDC and exhaustion of air continues as the volume decreases but the pressure remains almost constant.

The above processes mentioned are based on an ideal cycle. The actual cycle working may depend on the working condition.

VI. CONCLUSION

On the whole, the technology is just about modifying the engine of any regular IC engine vehicle into an Air Powered Engine. The Air Powered Engine technology is cheaper in cost and maintenance, can be easily adapted by the masses and it doesn't cause any kind of harm to the environment. Instead, its widespread use will help mankind in controlling the serious problem of global warming

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The Carbon Credit System: Beneath The Veil

In this day and age of liberalization and globalization, it has stretched far too thin of a line blurring the consumer travesty in the background but also coupled with economic growth due to it. The perpetual dynamics of creation, innovation, completion and entrepreneurial have rather been unabashedly replaced with entirely different dynamics, up in its gauntlet.

We've come about a realization toward the formation of the new demi-Government bodies and demi-Private Inc., is more concerned about budgets and quotas rather than growth, tilting the shift from corporate model towards bureaucratic model.

Earlier, the game was more focused on the production side of economy, aiming to control the means of the growth by having control to gauge access to capital. But the game is being focused more on the consumption side of the economy. The game has been carefully crafted to aim at the controlling the basic amenities of life: access to food and energy. And one neat way of doing it is by Emission trading and exercising carbon limits. The mechanism enables the bank-rolled enterprises to micromanage necessities of life on a global scale.

A carbon credit is a term for "any tradable certificate or permit representing the right to emit one-tonne of carbon dioxide or the mass of another green-house gas(GHGs) with a carbon dioxide equivalent to one tonne of carbon-dioxide". Or it is fashionably disguised as the digital form of capital sold or bought.

This carbon-credit regime is being sold as a solution to global warming and the propaganda campaign having being so successful, taking the whole bouts of environmentalists by storm and catching the fancy of the investors alike, it is a clever ploy to keep the cogs running. In Copenhagen, demonstrators confronted the police, carrying signs in support of carbon taxes and carbon credits.

As the new global regime has been consolidated, the IPCC has exhibited to implement mandatory annual carbon cap to each nation. With smart gauges and with psychometric analysis, energy use can be micromanaged all the way down to the number of minutes people spend in showers, or at what temperature people choose to do their laundry.

Creating a tree plantation in the third world can be 'traded' for continued emissions, even if a rain forest is cut down to make room for the plantation – and this overall transaction actually increases global CO2 levels. And there will surely be special cases, such as favoured industries, or government and military applications, where exceptions to the cap will be permitted. And in general, enforcement of industrial regulations tends to be notoriously lax.

The promise for reduction of Carbon Dioxide levels now seems a long forgotten illusion since the concentration of it only increasing over the atmosphere despite mandating Kyoto. But there is one

of those necessities. It has been surveyed that every industry burning fossil fuels will have additional costs added: the cost of obtaining carbon permits – by being the highest bidder. Those costs, plus profit margins, will be passed on to the consumer. The fossil alternatives, such as wind power and bio-fuels, will be only marginally lower in price: it is IPCC-imposed fossil fuel scarcity that will set the price in each market segment, as we already see with world grain prices. All of this will encourage speculative investment in futures markets, which will increase prices still further – and with all this happening it is very much evident from the fact: fluctuations already happening with global food prices.

The numerous schemes laden by the top drawer and small-time corporate, it is the new economic play-field that in which the Credits, like any high value asset, effectively works as a currency, can legitimately pass in large numbers and between jurisdictions really quickly. It is is only a matter of time to standardise the practices of this multi-billion dollar industry, which still at the cusp of coming full of age.

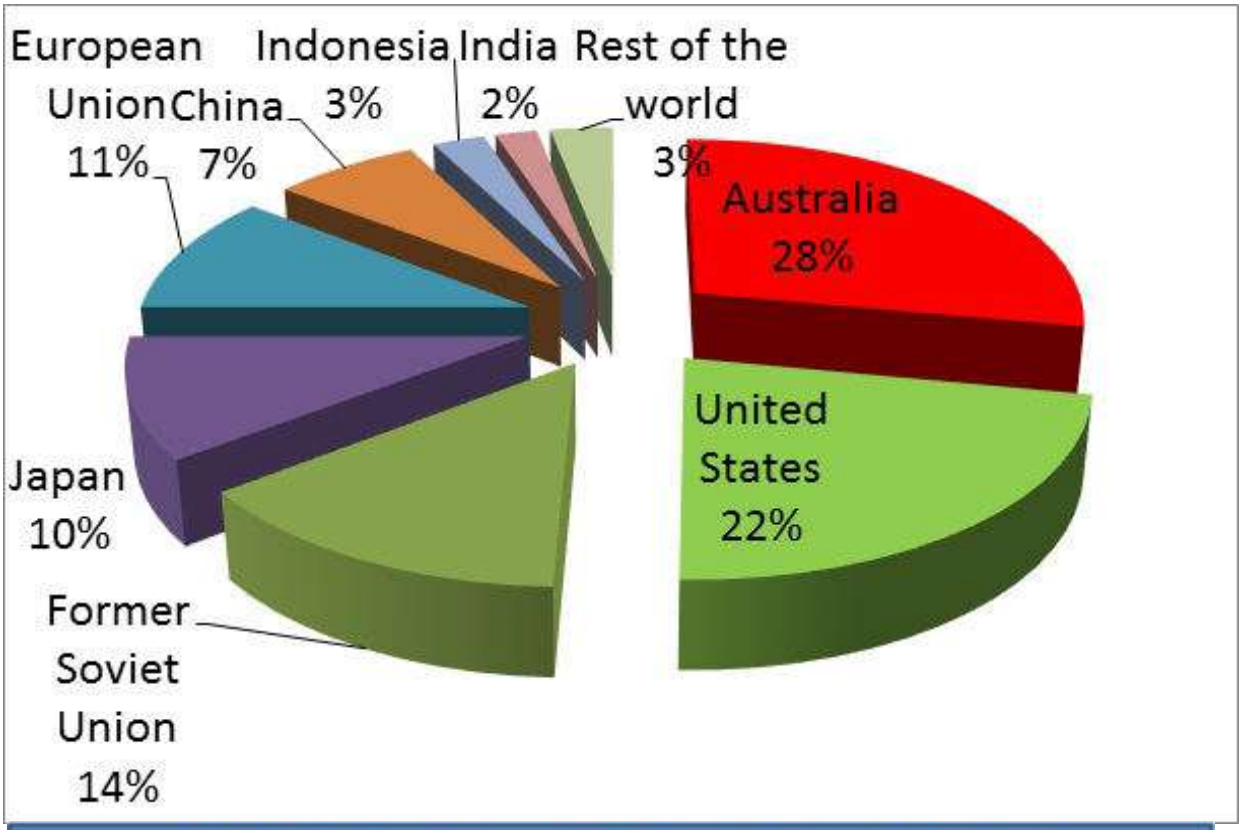


Fig : Carbon emission % in few business countries

Udai Deora
Be Mech

Oddities in Space

Technology is making great leaps in every sector. The last 40 years saw the first mobile phone evolving to become an inseparable part of our lives- the smart phone. From having developed the Standard Model of particle physics to discovering the God Particle. In a time of accelerating scientific research, it is strange that our forages into space are retarding. We went from having made 6 manned missions to the moon to 0. It is incredible to think that in a few short years, not a single man alive on this earth would have walked on the moon.

The budgeting for space research has decreased all over the world. In that regard, at least India has fared better. Funding for ISRO (Indian Space Research Organization) has steadily increased over the years. Last year (2013-2014), ISRO had a budget of Rs. 5615 Crore mainly spent on launch vehicles and the Mars Orbiter Mission. Out of this, 27 crores were devoted to manned space flight research. A small number to be sure, but important nevertheless. As a country, we are striding in the right direction.

It can be argued that manned space flight may have decreased but research has increased overall. We have built a space station and sent various rovers to Mars after all. But the truth is that year by year, the number of specialists in the field are decreasing. We are not doing our best. We sent men to the moon in 1969 powered by a computer with a memory of 64 KB and a 2KB RAM. Is it really believable that we are not capable of more when even the mobile in your hand has 1000x more power? Why has the aerospace sector become neglected? I would like to quote a rant by the famous astrophysicist, Neil deGrasse Tyson:

When someone says, "We don't have enough money for this space probe," I'm asking, no, it's not that you don't have enough money, it's that the distribution of money that you're spending is warped in some way that you are removing the only thing that gives people something to dream about tomorrow.
You remember the 60s and 70s. You didn't have to go more than a week before there's an article in Life magazine, "The Home of Tomorrow," "The City of Tomorrow," "Transportation of Tomorrow". All of that ended in the 1970s. After we stopped going to the Moon, it all ended. We stopped dreaming.

That is it perhaps. We stopped dreaming. There is no wonderment for space anymore. Nothing to excite the general public. It is not enough to have more people entering the field. Everyone needs to wonder and be amazed by the universe. In some small way, I shall try to remedy that with this article.

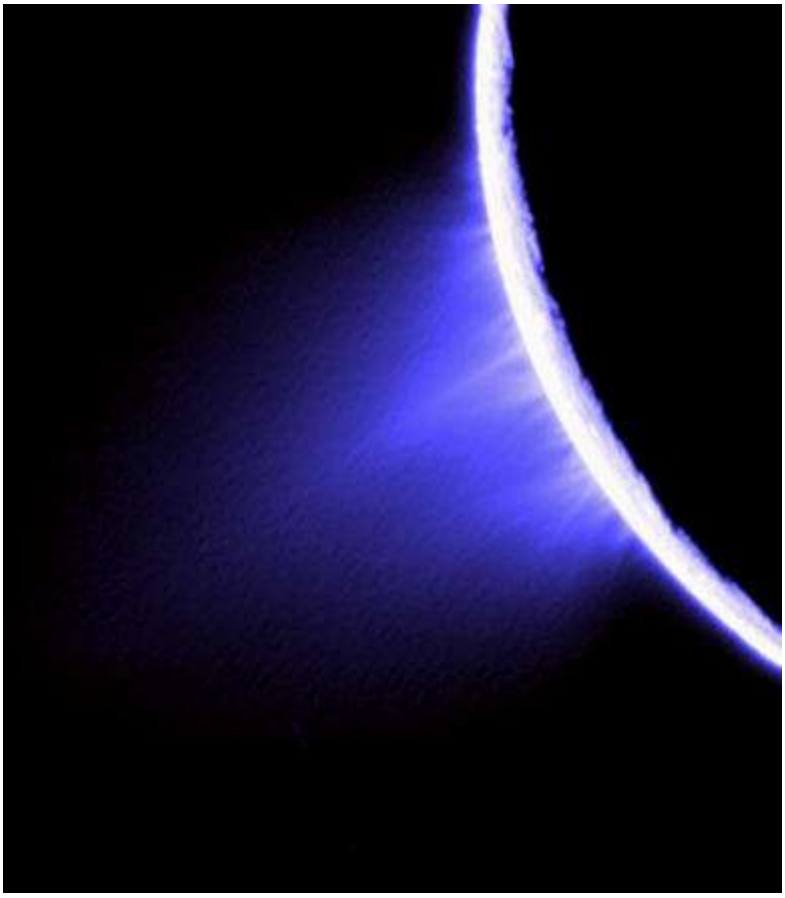
Described below are 5 wonders from space which we should have been taught about instead of having to mug up the temperature and distance of the sun.

5. Cryo-Volcanoes

Cryo Volcano literally means Ice Volcano. It is a volcano that erupts materials with low boiling points such as water, ammonia and methane instead of molten rock. These volcanoes are found on icy bodies such as the moons of the outer planets of our galaxy. The substances erupted are usually liquid but freeze as soon as they come out of the volcano due to the low temperature of the surrounding landscape. Due to the low gravity on most of these moons, the eruptions form huge

plumes which can spread out almost 500 Kms above the surface.

Cryo Volcanoes were first directly observed on Triton, a moon of Neptune, and then later seen on Enceladus, a moon of Saturn. Indirect proof of cryo volcanoes have been found on various other moons.

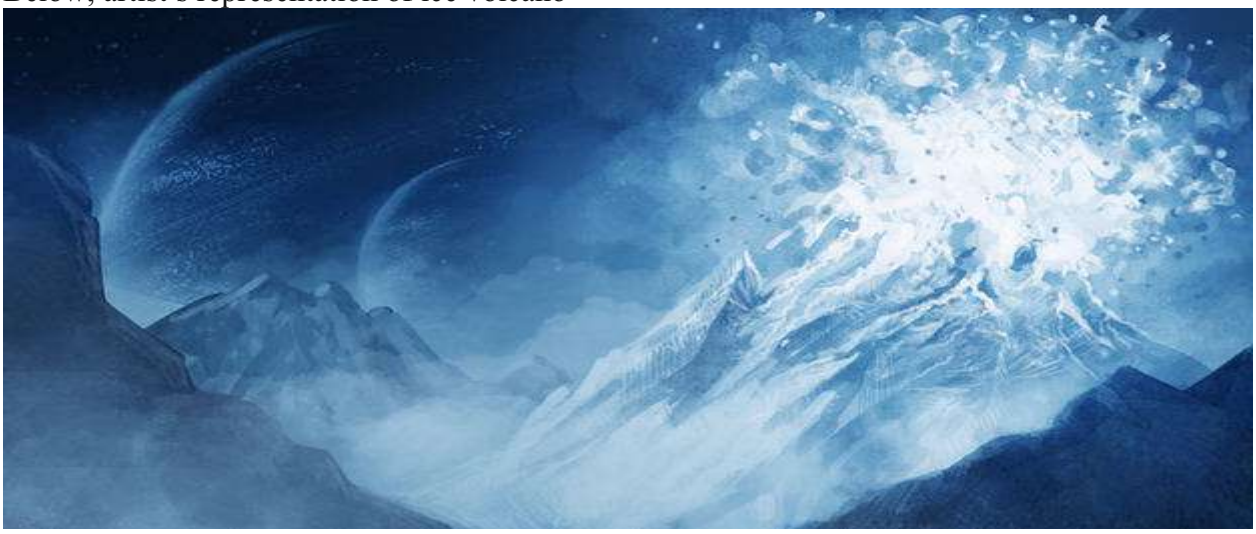


Above; Image of the Ice Jets as taken by the Cassini Mission (2005)

But how does Cryovolcanism work? How is it possible for a structure that on earth erupts with lava of temperatures exceeding 700 °C to instead throw out icy liquid at temperatures below zero? Let us consider a traditional volcano. Magma rises out of a volcano as it is hotter and hence less dense the surroundings. The magma gains this heat from the interior of the Earth.

The moons which have demonstrated Cryo volcanism are icy cold and do not have enough residual heat in their cores to sustain volcanoes. Instead it is thought that the volcanoes are powered by heat generated by tidal strain from the gravity of the planets they observe (Similar to how the moon causes tides in the earth's oceans.) The tidal strain heats the liquid below the surface to slightly above the surface temperature and causes Icy Volcanoes!

Below; artist's representation of ice volcano



4. Hyper Velocity Stars

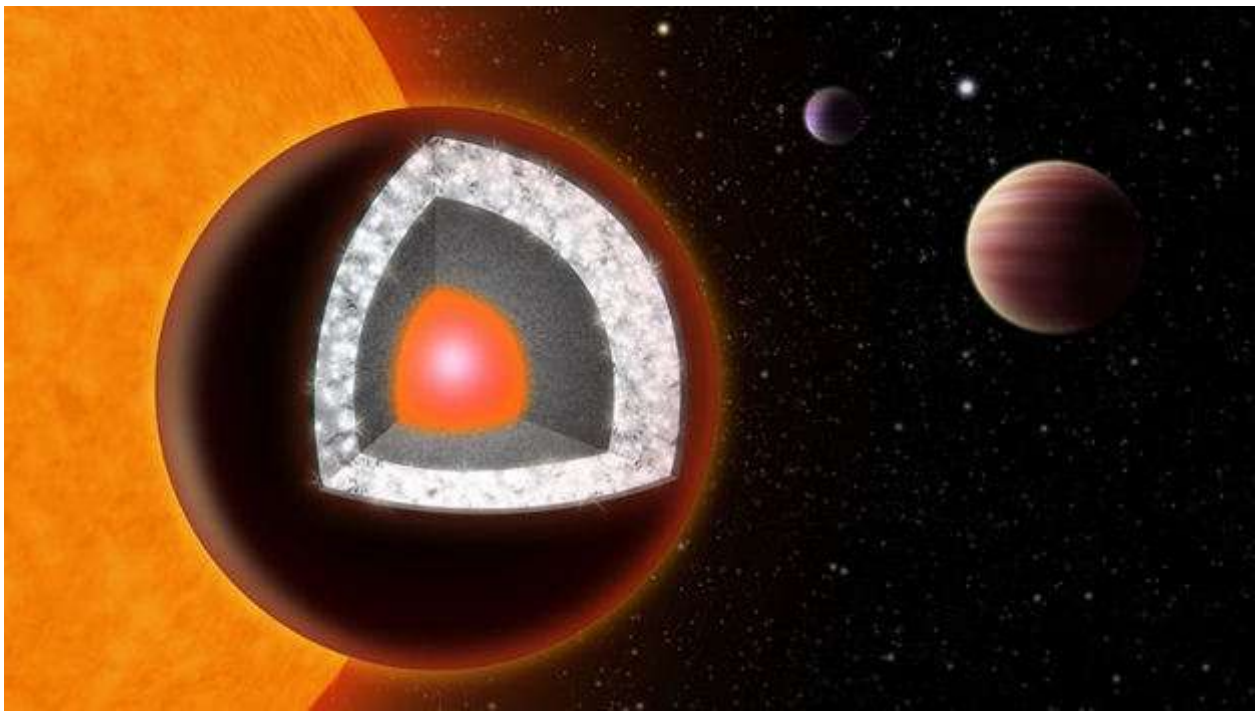
This class of stars has a name right out of a sci-fi movie. Meet SDSS J090745.0+24507, the runaway star. First observed in 2005, the star was seen doing something very different from all the stars in our galaxy. It was leaving.

SDSS J090745.0+24507 was seen moving along at a speed of about 700 km/s, EXITING the galaxy. It is thought to have originated in the center of the galaxy. After the discovery of further hyper velocity stars, astrophysicists have a fair idea of how they are formed. They are formed near the center of the galaxy and are parts of binary star systems.

A binary star system is a system in which two stars are orbiting each other. Due to the high gravitational pull on each other and because they are orbiting near the massive black hole at the center of our galaxy, the system tends to acquire a high momentum. If one of the stars is sucked in by the black hole, the other star slingshots out while retaining most of the momentum of the system.

Let us put the speeds in perspective. The escape velocity (i.e. the velocity required for an object to escape the gravitational field of a body) of earth is 11.2 Km/s. The escape velocity for our galaxy is about 500-600 km/s. Most hyper velocity stars which are escaping the galaxy are travelling at a rate of 700-1000 km/s. Just imagine, big balls of fire and gas four times larger than our sun, streaking through the galaxy at millions of kilometers per hour.
If it wasn't already amazing enough, data from just this year shows a new group of hyper velocity stars which flout the rules that scientists thought governed the other stars. These stars do not seem to originate at the center of our galaxy and are heading in arbitrary directions. How these stars acquired such speeds has baffled every scientist.

3. Planets Made Of Diamond



Twinkle twinkle little star, How I wonder what you are. Up above the world so high, like a

diamond in the sky.

Turns out there is more truth to this nursery rhyme than we ever imagined. If it hasn't sunk in yet, let me clarify. Scientists have found whole planets which are composed mostly of diamond. Referred to as Carbon Planets by those with no imagination (aka the scientists), these planets are composed mostly of oxygen and carbon. Under high pressure and heat, the carbon presents itself in the crystalline form, i.e., Diamond and graphite

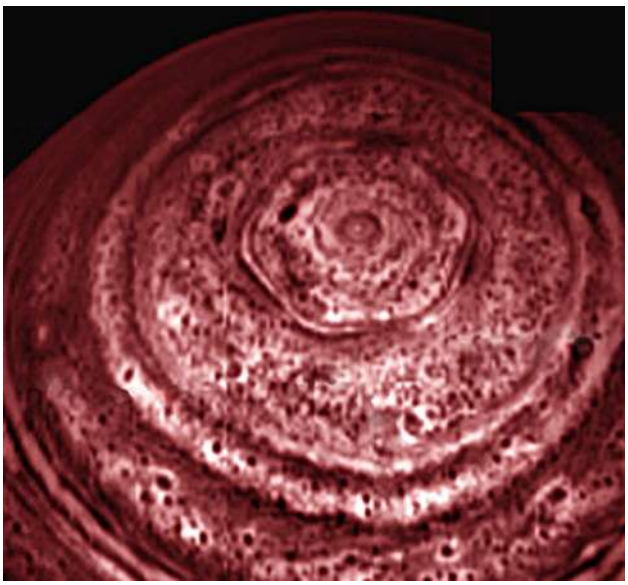
One of the rarest and treasured rocks on earth and there are whole planets made of it. Planets which are 2-3 times the size of earth. And if you think this is a one off freak occurrence, think again. Up till now, we have discovered PSR J1719-1438 b, WASP-12b and 55 Cancri e. All planets made of diamond. There is also a star which is theorized to have a core of diamond.
Conclusion? The universe likes its bling.

2. A Hexagonal Storm

This next wonder can be found just around the corner (on a cosmic scale that is). The Hexagon Cloud System can be found on Saturn, just 3 planets over. Storms on other planets like Neptune and Jupiter are exactly like on earth . Circular. But Saturn decided to take it to the next level.

Not satisfied with looking like the ninth circle of hell, this cloud formation has been around for as long as we know. It was first spotted in 1981. This isn't exactly small stuff either. Each wall of the hexagon is 13,800 km long. The Earth's diameter is around 12,700 km only.

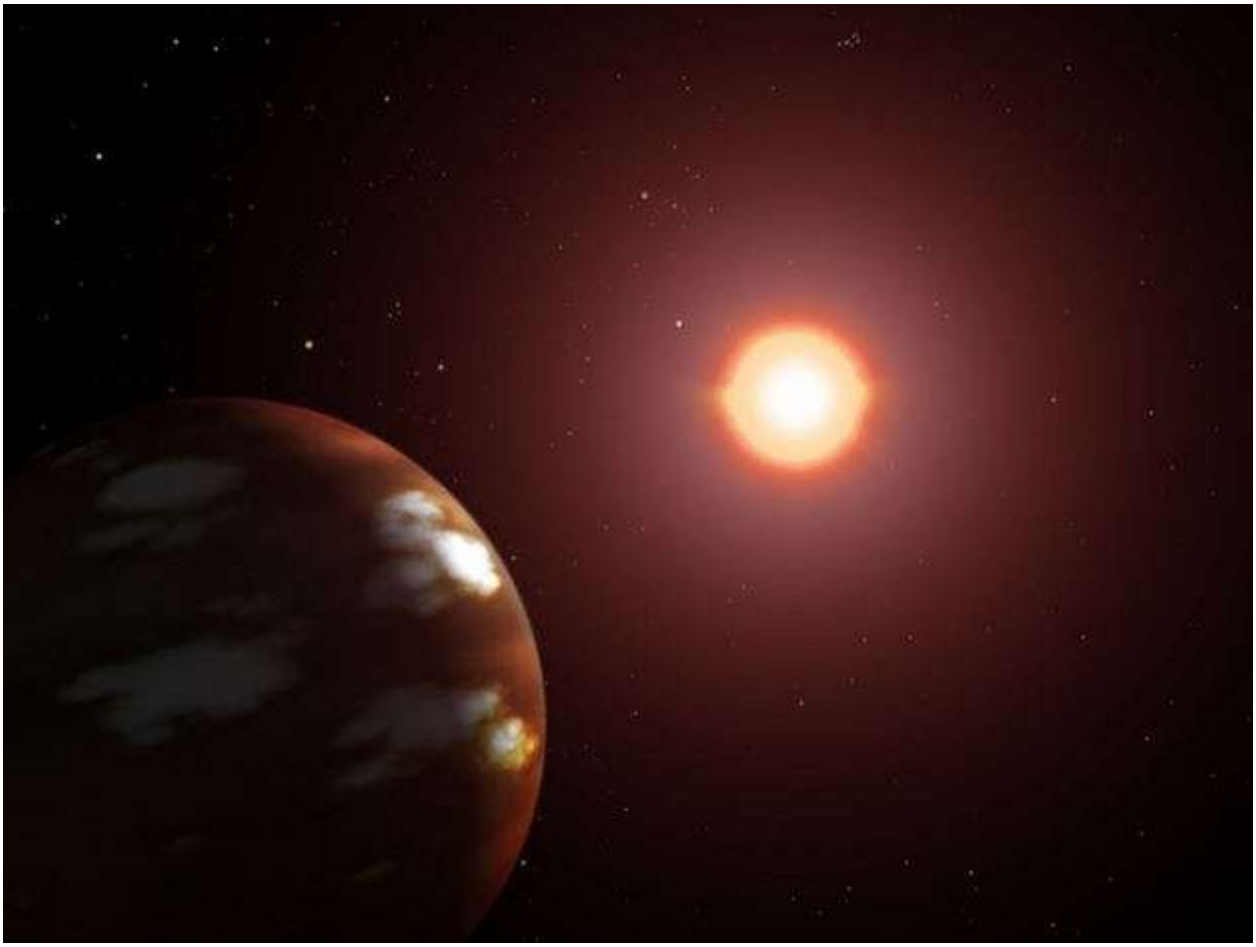
So have scientists been able to provide an explanation? Surprisingly, they have. They proved that a steep difference in the spin rates of the winds in various parts of the formation, led to polygonal patterns. The theory was tested using a drum of water which had the base and lid divided into various concentric circles. When the circles were rotated at speeds with high difference, polygonal waves and patterns like those on Saturn were produced.



Saturn's North Pole

1. A Burning Planet…Made Of Ice

Allow me to introduce Gliese 436 b, a planet which always measures at a balmy 439 °C. This is approximately the temperature found on Mercury. Mercury, as everyone knows, is a rocky planet with major cracks on its surface due to the intense temperature.
Gliese 436 b decided to turn common sense on its head by being both made of ice and having a scalding surface temperature of 439 °C. So how exactly does ice exist at four times its boiling point? The explanation might lie behind its massive size. This planet is approximately the size of Neptune. The gravity of the planet applies immense pressure on the water vapour in the atmosphere and solidifies it into a layer of ice which coats the whole planet.



Such ice has been dubbed as Ice Ten by the scientists. Ice Ten melts at between 700 °C to 2000 °C. Do not be fooled by the usage of the word ice in its name. It is not cold. Ice Ten will melt your hand off if you attempt to hold it.

This article has been written from the various open sources from internet.

Utkarsh Mittal
TE Comps

Six Stroke Engine

The automotive industry uses mainly 4-stroke and 2-stroke engine. But these engines have some shortfalls in terms of fuel efficiency. To overcome this, there has been considerable research going on. One of the results of such a research is a six stroke engine.

The six-stroke engine is based on the four-stroke engine, but with additional complexity that improves its efficiency and reduces emissions. There are two approaches developed since the early 1890s:

Single piston design, one that captures heat lost from the 4-stroke cycle and captures the lost heat to power an additional power and exhaust stroke.
The pistons reciprocate three times for each injection of fuel and has two power strokes: one with fuel and the other with steam or air.

Another approach is the opposed piston design that uses a second opposed piston in each cylinder that moves at half the cyclical rate of the main piston, thus giving six piston movements per cycle. Functionally, the second piston replaces the valve mechanism of a conventional engine

Single piston designs

There are various types of engines in this design.

Griffin six-stroke engine

Engineer Samuel Griffin was an established maker of steam and gas engines. He wanted to make an internal combustion engine without paying royalties to Otto and so a single piston six stroke engine was born. Scottish steam locomotive maker Dick, Kerr & Co. saw a future in large oil engines and licensed the Griffin patents. The Griffin engine was capable of running light for long periods which made it popular in power generation. The construction was bulky which was not suitable for mobile use.

The engine used a heated exhaust-jacketed external vaporizer, into which the fuel was sprayed. The temperature was maintained at about 550 °F (288 °C), sufficient to physically vaporize the oil but not to break it down chemically. This fractional distillation supported the use of heavy oil fuels, the unusable tars and asphalts separating out in the vaporizer. Hot bulb ignition was used, which Griffin termed the "Catathermic Igniter", a small isolated cavity connected to the combustion chamber. There are only two Griffin engines still in existence, one of which is in the Anson Engine Museum while the in the museum of Bath.

Bajulaz six-stroke engine

This engine was invented by Robert Bajulaz in 1989 in Switzerland.The Bajulaz six-stroke engine is similar to a regular combustion engine in design, however, with modifications to the cylinder head

with two supplementary fixed capacity chambers: a combustion chamber and an air preheating chamber above each cylinder. A large amount of heat enters the combustion chamber and the injection of fuel is isochoric. The high pressure achieved is then released into the cylinder to work the power or expansion stroke. The air in a second chamber that blankets the combustion chamber is heated to a high degree by heat passing through the wall. This heated air makes up the additional stroke of the engine.

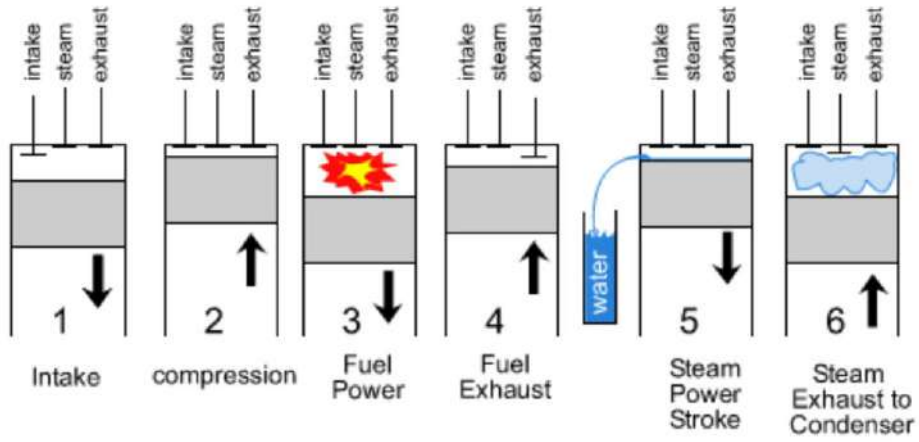
Velozeta six-stroke engine

Developed in 2005 as a college project, the Velozeta engine became a business opportunity for Mr. U Krishnaraj, Mr. Bobby Sebastian, Mr. Arun Nair and Mr. Aaron Joseph of the College of Engineering, Trivandrum. Fresh air is injected into the cylinder during the exhaust stroke, which expands by the heat and hence forces the piston down for an additional stroke. This engine has improved fuel efficiency and a reduction in exhaust gas emission. It can run on any type of fuel as only air is used for the additional strokes.

Crower six-stroke engine

Bruce Crower first made a prototype of this engine. It is similar to the Velozeta engine with the difference being that water is injected instead of air to get the additional stroke. This water gets superheated due to the high temperature and is instantly turned into steam which expands and forces the piston down for an additional stroke.

This eliminates the need for a cooling system as the waste heat is recovered. This engine was estimated to bring down fuel consumption by 40% and to produce more power at lesser rpm.



Opposed piston designs

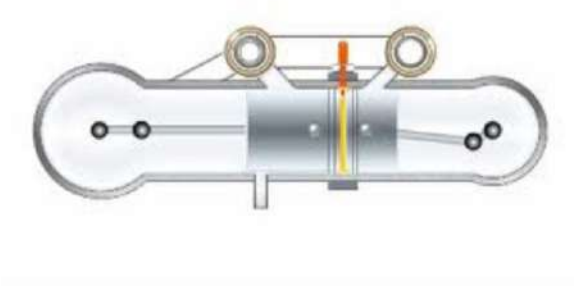
These designs use two pistons per cylinder operating at different rates, with detonation occurring between the pistons.

Beare Head

This design was developed by Malcolm Beare of Australia.The Six stroke Beare Head simply replaces the conventional Four Stroke Engines Cylinder Head. The Beare Head utilizes an overhead short stroke Crankshaft and Piston arrangement which opens and closes Inlet and Exhaust Ports leading through the Upper Cylinder Liner. Functionally, the cylinder head replaces the valve mechanism of a conventional engine. The Beare Head Technology can be fitted to new production engines or retro-fitted via aftermarket replacement.

The top and bottom Crankshaft are connected via a drive chain or toothed belt. The Beare Dual Opposed Piston Six Stroke Engine results in having Two Pistons Operating and producing power within each cylinder. The additional torque and power further generated by the Top Piston/Crank of the Beare Cylinder Head is then channeled via the connecting drive chain to the Bottom Crank.

Piston charger engine



The design is similar to the Beare head. A Piston Charger replaces the valve system. This charger charges the main cylinder and also regulates the inlet and outlet aperture. In the main cylinder, combustion takes place every turn as in a two-stroke engine and lubrication as in a four-stroke engine. The benefit of fewer moving parts and design is claimed to lead to lower manufacturing costs. The engine is claimed to be suited to alternative fuels since there is no corrosion or deposits left on valves.

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SUPERCRITICAL FLUIDS

ABSTRACT:

We all have studied about many types of fluids especially in Fluid mechanics viz. Ideal, Real, Newtonian, non Newtonian etc. but how many of us have heard about SUPERFLUIDS!! Hardly any of us. Its one magical fluid everyone should know about.

When matter is pushed to a temperature and pressure beyond its critical point we find it difficult to distinguish whether it is a fluid or a gas. This is when supercritical fluid comes into picture. Nowadays SCF has found many applications in dry-cleaning, fluid extraction, chromatography, etc.

WHAT IS SUPERFLUIDITY?

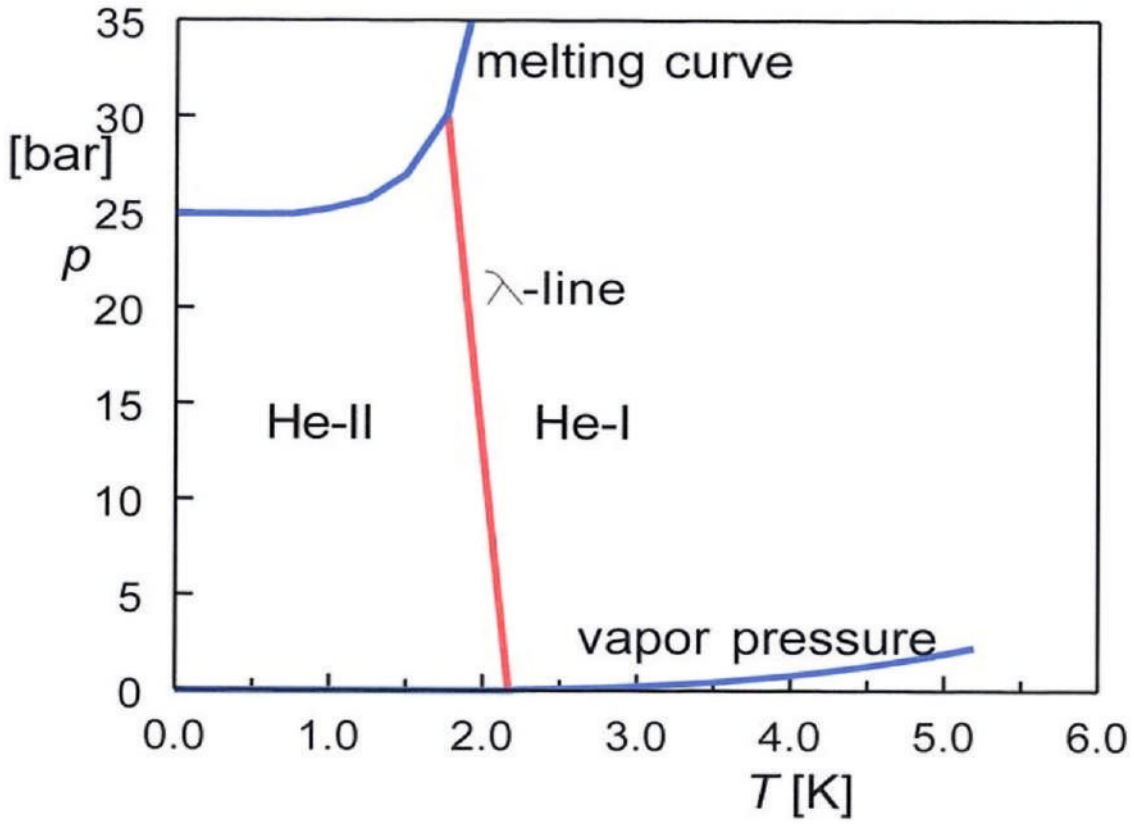
A SCF is defined as a substance above its critical temperature (T_C) and critical pressure (P_C). Superfluidity is a fluid which behaves like a fluid with ZERO VISCOSITY; where it appears to exhibit the ability to self-propel and travel in a way that DEFIES THE FORCES OF GRAVITY and SURFACE TENSION. It disobeys the rules of surface tension and capillarity. It also possesses high thermal conductivity. A superfluid in a glass tube will literally CRAWL UP the side of the tube in a thin film because of this property.

The superfluidity effect was discovered by John F. Allen, and Don Misener. A liquid goes superfluid when it suddenly loses all internal friction and gains near infinite thermal conductivity. The combination of zero viscosity but nonzero surface tension allows a superfluid to creep up walls and back down the outside to drip from the bottom of open containers, or to completely cover the inner surface of sealed containers. Lack of viscosity also allows a superfluid to leak through a surface that is porous to any degree, because the molecules can slip through even microscopic holes. Superfluids furthermore exhibit a thermo-mechanical effect where they flow from colder to warmer temperatures, exactly the opposite of heat flow as stated by the laws of thermodynamics.

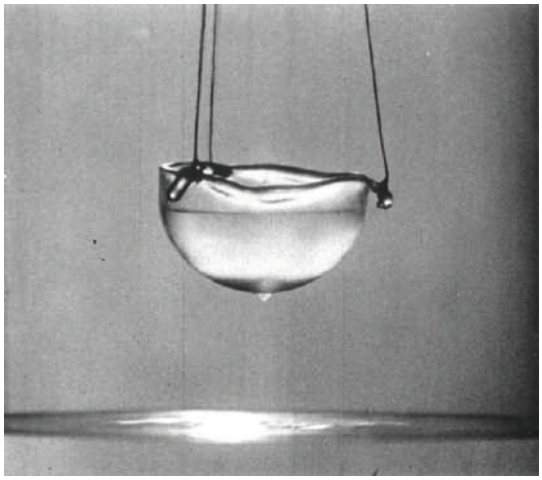
Properties of SCF:

1: density, polarity, viscosity can be controlled over a wide range.
2: fluids carry zero entropy.
3: it is a volatile substance.
4: solubility of the SCF depends upon density which depends upon pressure so, solubility of the SCF can be controlled by just varying the pressure.
5: all SCFs are completely miscible with each other.

The main example of superfluid is Liquid Helium. The chemical element helium exists in a liquid form only at the extremely low temperature of −269 ºC (about 4 K or −452.2 ºF). Hence superfluidity occurs only at temperatures around absolute zero, precisely 2.172K



FILM FLOW:



Many ordinary liquids, like alcohol or petroleum, creep up solid walls, driven by their surface tension. Liquid helium also has this property, but, in the case of He-II, the flow of the liquid in the layer is not restricted by its viscosity but by a critical velocity which is about 20 cm/s. This is a fairly high velocity so superfluid helium can flow relatively easily up the wall of containers, over the top, and down to the same level as the surface of the liquid inside the container. In a container, lifted above the liquid level, it forms visible droplets as seen in figure.

The liquid helium is in the superfluid phase. As long as it remains superfluid, it creeps up the wall of the cup as a thin film. It comes down on the outside, forming a drop which will fall into the liquid below. Another drop will form – and so on – until the cup is empty.

Helium II will "creep" along surfaces in order to find its own level – after a short while, the levels in the two containers will equalize. The Rollin film also covers the interior of the larger container; if it were not sealed, the helium II would creep out and escape.

Practical application:

In 1999, one type of superfluid was used to trap light and greatly reduce its speed. In an experiment performed by Lene Hau, light was passed through a Bose-Einstein condensed gas of sodium (analogous to a superfluid) and found to be slowed to 17 meters per second (61 km/h) from its normal speed of 299,792,458 meters per second in vacuum. This does not change the absolute value of c, nor is it completely new: any medium other than vacuum, such as water or glass, also slows down the propagation of light to c/n where n is the material's refractive index. The very slow speed of light and high refractive index observed in this particular experiment, moreover, is not a general property of all superfluids.

The Infrared Astronomical Satellite IRAS, launched in January 1983 to gather infrared data was cooled by 73 kilograms of superfluid helium, maintaining a temperature of 1.6 K (−271.55 °C). Furthermore, when used in conjunction with helium-3, temperatures as low as 40 mK are routinely achieved in extreme low temperature experiments.
Superfluid-helium technology is used to extend the temperature range of cryocoolers to lower temperatures. So far the limit is 1.19 K, but there is a potential to reach 0.7 K
Besides the space applications SCFs are also used in dyeing, nano particle formation, supercritical drying, power generation, biodiesel production, refrigeration, water hydrolysis, etc.

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