Mechazine

2015

VOLUME 1

A Journey Through ISS

We explore the largest artificial satellite ever put in space

F1 Legacy

Pioneering automotive technology

INDIA's Venture Into A Whole New Economy

Exploring Time

Delve into the past or blastoff to the future

Dearman Engine

Cryogenic Propulsion

REAL MECHANICA
DEPARTMENT OF MECHANICAL ENGINEERING
RSET

Rajagiri Anthem

Rajagiri -Oh the Hill of the King
Reign you as the caring king
Reaching out to souls come seeking
Righteous way of true living.
Be you the dream of searching minds
A beacon of light, with a vision to guide
Bold in the mission to excel ever
Bright in our learning endeavour.
Training to transcend the limits of time
Spreading its wings surpassing the space
Leading way to integrity
From bondage to spirit of freedom.
Critical outlook and creative act
Reflective poise for a committed cause
Fed by the fire of conviction
Achievement of glory in service.
Chorus:
And for us Rajagirians, Rajagiri is.....
Our way life, our task, 'n tradition
A luminous star o the learning horizon
We cherish the way you nourish your own
And pledge ourselves to do you proud.

Mechazine 2015 volume I

Real Mechanica

Department of Mechanical Engineering

Rajagiri School of Engineering & Technology

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EDITORIAL

"Life has no smooth road for any of us; and in the bracing atmosphere of a high aim the very roughness stimulates the climber to steadier steps, till the legend, over steep ways to the stars, fulfills itself. "

This being the second issue of Mechazine we had a lot of obstacles and challenges to face, but the team was equally enthusiastic and excited to work for our own mechanical department magazine. The perseverance of the core team has made this Mission Possible.

Speaking about the support, we got a lot of backing-up from the Principal and Vise Principal of the college. The principal has always been a great support to our department and I sincerely thank him for giving us this opportunity. I also thank the entire department, the HOD and the faculty for their ardent support.

The course material we follow is outdated or obsolete due to quick advancements in technology. Hence we should not limit the source of our knowledge to the college curriculum. We the students of the Mechanical Engineering Department have understood this need, and have thus decided to create this magazine. We hope to build a suitable platform to share information about the latest in engineering.

The show has begun… someone may just pull the rabbit out of the hat..! Enjoy…

Jithin Jose
Joel Augustine
S6 ME

2014 Mechazine

Principal's Message

I feel extremely delighted to observe that technical magazine ; MECHAZINE from department of Mechanical Engineering is to coming out this year for the second time, thanks to the dedicated and committed efforts of the faculty and the students of the department. The magazine is truly the reflection of the interest of the students,involved in technical endeavours.

Ever since the inception of Mechanical Engineerin department in 2011, we have been striving for excellence in different areas of Mechanical Engineering and Technology, and at the same time marching forward with the mission of professional as well as intellectual development of the students,i feel gratified that we are doing our best in carrying on the mission of grooming our students as such professionals who are not only competent enough to combat the challenges in their life but also become good human beings with moral excellence and social sensitivity. I congratulate the efforts of the members of the editorial board that they have brought out the second issue of the magazine in such an informative form. It is because of their selfless and untiring efforts that we see the magazine enriched with variety of articles.

As a parting message to students of Mechanical Engineering, I wish them a pleasant and prosperous future and advise them to delve deep in their career and come out with the pearl of name and fame ,both for themselves and their future.

Dr. A Unnikrishnan
Principal
RSET

Vice Principal's Message

With the second consecutive edition of the Mechazine being brought out,the students of the Mechanical Engineering Department have proved Jean Paul Sartre's words, "Commitment is an act, not a word".

I am indeed proud that you have persevered in your efforts despite work pressures, having to live up to expectations and above all ,having to keep up high standards that have already been set.

The magazine is a reflection of the technical know-how of the students. Today we live in a kaleidoscopic world of technical advancement and an explosion of knowledge from which the young minds learn to explore, dream and discover.

Technical skill dove tailed with a human personality makes up a complete individual and that is what I am happy to see among the students of RSET.

Let me express my sincere congratulations and appreciation for all those who worked tirelessly behind the success of this magazine. I am sure that the same fervor and commitment with which this achievement became reality will continue always because after all,there can be no abiding success without committment.

Dr.John M George
Dean and Vice Principal
RSET

HOD's Message

On behalf of all the staff and students of the Mechanical Engineering Department, a very warm and affectionate welcome to the second issue of Mechazine. I congratulate all the students and faculty members in bringing out the departmental technical magazine in spite of having a busy academic schedule.

The first batch of B. Tech students will be passing out in June 2015 and this year is going to be a memorable year for the department. We are proud to have a reasonably good placement record right in the first batch itself even though most of them are in the software industry. This year the department has organized certification courses in CATIA and AUTOCAD. In addition, a two day workshop on robotics has also been organized.

On this occasion I would like to bring to the attention of all Mechanical Engineering students the importance of Graduate Aptitude Test in Engineering (GATE) examination for securing a placement in core companies. GATE is an all India examination which examines the comprehensive understanding of various undergraduate subjects in engineering and science. The candidate can choose from any of the 22 disciplines including Mechanical Engineering. Admissions to the various PG courses in engineering at most of the prominent institutions across the country including IIT's and IISc are on the basis of GATE score. GATE has been gaining more recognition during the last couple of years and even some of the foreign universities have been admitting students on the basis of GATE score. For example the National University of Singapore is admitting students for MS and Ph.D programs based on GATE score. Apart from higher education, GATE scores are being increasingly used for recruitment of engineering graduates in many Public Sector Units (PSU's). Mechanical Engineering graduates who secure a good score in GATE examination are welcomed by top PSU's in the country with well paying jobs. Top PSU's who are recruiting Mechanical Engineers through GATE 2015 includes ONGC, BPCL, Indian Oil, HPCL and NTPC.

Preparation for GATE should ideally start from the second year of graduation since most of the topics included in the GATE examination are studied during the second and third year. In the GATE examination the ability of the candidate to apply engineering principles to solve practical problems is being tested. Therefore, students attempting the GATE examination should possess a thorough understanding of the basic engineering principles of their respective discipline. Mock tests and sample papers are an integral part of the GATE preparation.

At Rajagiri we are conducting coaching classes for GATE examination. Mock tests are also being conducted in the campus for the final year and pre final year students. I advise all the students who dream for a job in core companies to prepare well and appear for the GATE examination. I am hopeful that in the coming years more number of students from the department will secure good score in GATE and will get placed in top PSU's in the country.

Best regards

Manoj G Tharian.

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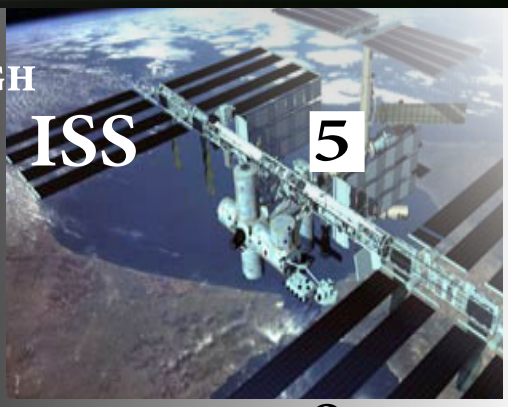
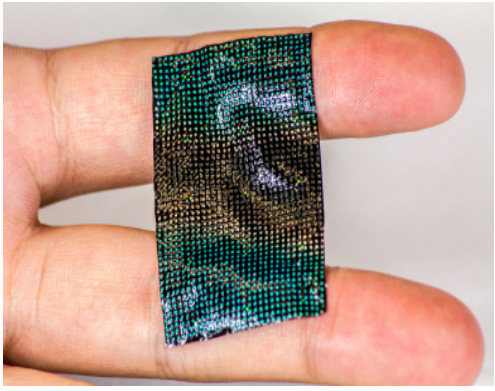
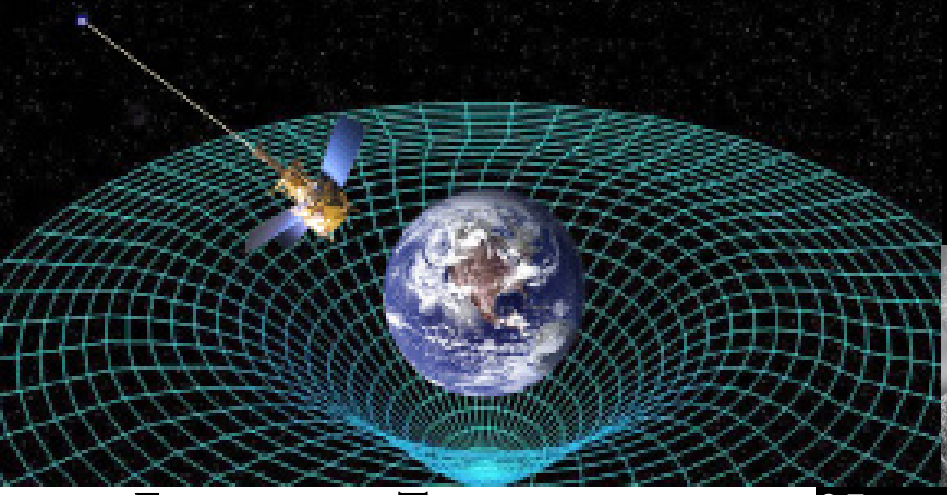
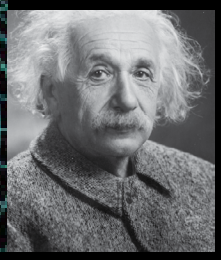
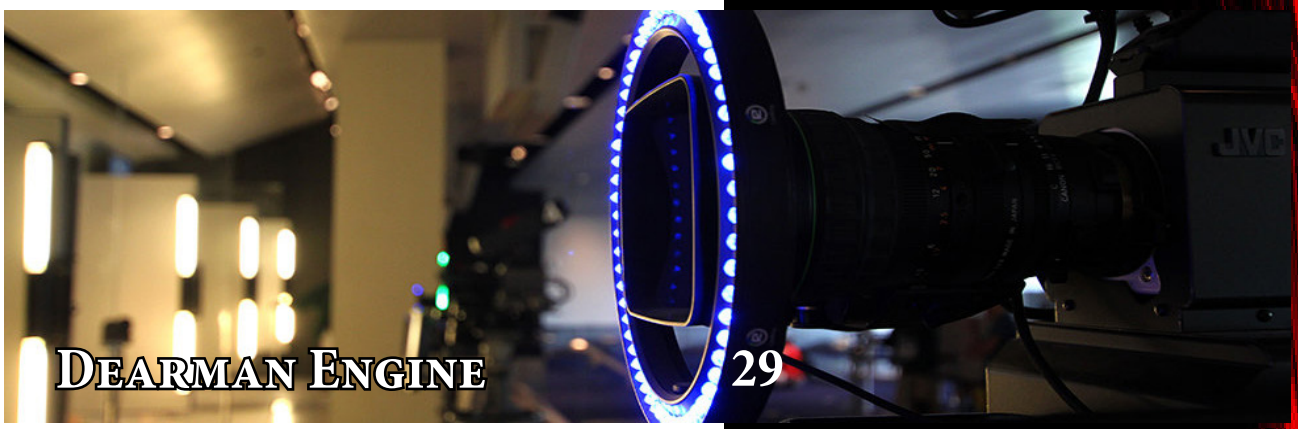


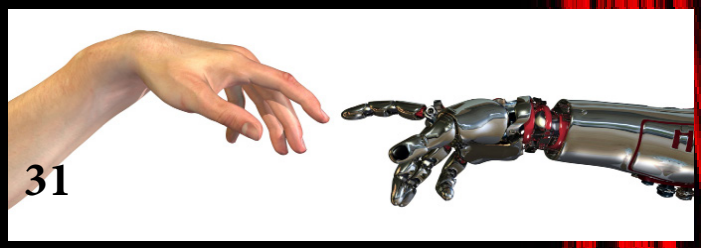


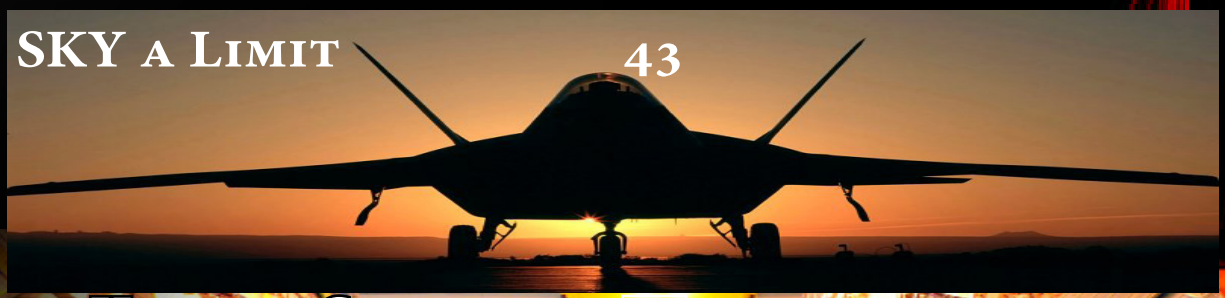
Mechazine 2015

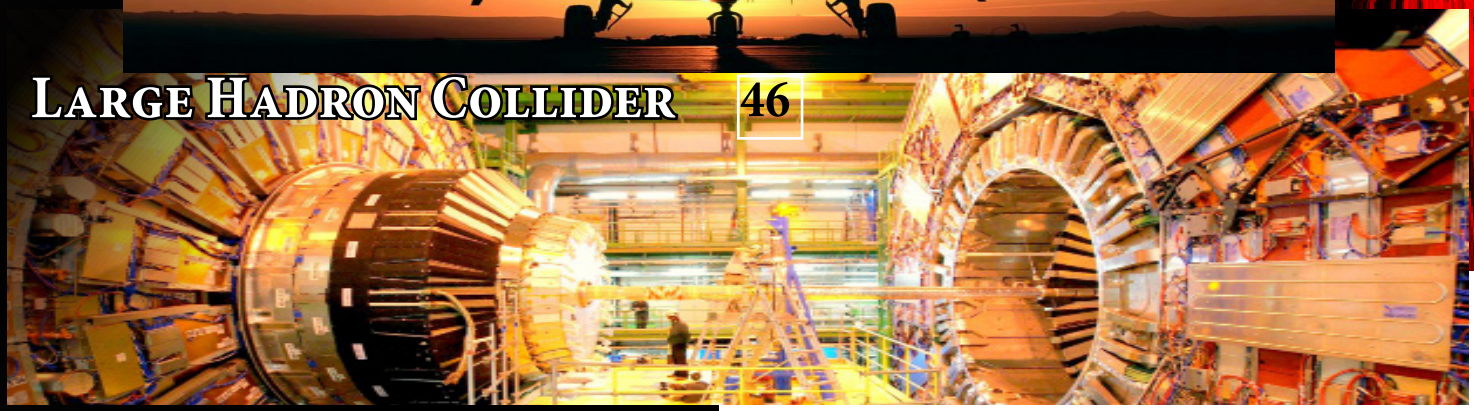












The Future of Hybrids and Electrics - I

With the ever increasing rate of depletion of fuel sources, it's certain that Hybrid Vehicles and Electric Vehicles will dominate the future in automotive sector. But the main problem with these are that the batteries take up a lot of space and are very heavy. Even with advances in lithium-ion batteries, hybrids have a significant amount of weight from their batteries. That's where energy-storing body panels come in.

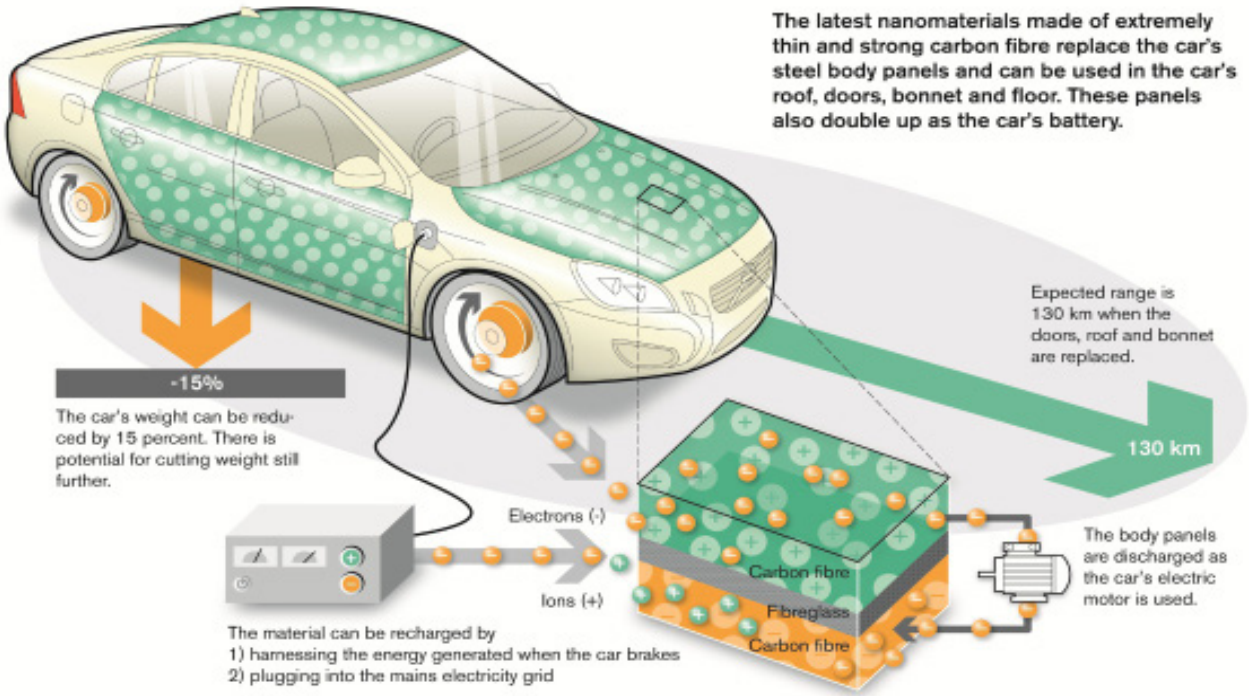
In Europe, a group of nine auto manufacturers are currently researching and testing body panels that can store energy and charge faster than conventional batteries of today. Lithium-ion batteries have a lot of energy, but are limited in how fast they can discharge it. Supercapacitors can release energy in large bursts, but don't store as much as a Li-ion battery. The trick is to combine the two in the short term, while figuring out how to store more in the supercapacitor in the long term.

Energy Storing Body Panels

Queensland University of Technology is working on new lightweight supercapacitors, which are a thin, strong, high-energy density film made of two all-carbon electrodes sandwiched around an electrolyte. This film is intended to be set in car body panels, roofs, doors, bonnets and floors. The idea, in the short term, is to combine them with Li-ion batteries, where the supercapacitors can store enough energy to charge the battery in minutes.

The body panels being tested are made of polymer fiber and carbon resin that are strong enough to be used in vehicles and pliable enough to be molded into

The car's body panels serve as a battery



panels. The panels would capture energy produced by technologies like regenerative braking or when the car is plugged in overnight and then feed that energy back to the car when it's needed. Not only would this help reduce the size of hybrid batteries, but the extra savings in weight would eliminate wasted energy used to move the weight from the batteries. It will reduce the weight of the car by about 15%. Advanced Nano-Structured batteries and supercapacitors are deftly incorporated into carbon fiber panels using an advanced resin; the panels are in turn formed to fit around a car's frame. Just as with a conventional EV (electric vehicle) battery, the super capacitor-infused material can be fully charged via the power grid or refreshed via regenerative braking.

Energy storing panels aren't just limited to electric vehicles, though. The idea is that even traditional gas powered vehicles can incorporate the energy storing panels into their design and eliminate the need for traditional batteries, saving drivers a lot of headaches.

A super capacitor-powered car would have other advantages. For example, because supercapacitors use carbon and not rare earths like lithium, they're much cheaper to produce and are less toxic than the conventional batteries.

The idea of fabricating super capacitors instead of Li-Ion batteries onto the body panels of cars has been brought about by Volvo. Whereas Toyota is looking one step further and researching body panels that would actually capture solar energy and store it in a lightweight panel.

In the future, it is hoped the super capacitor will be developed to store more energy than a Li-ion battery while retaining the ability to release its energy up to 10 times faster – meaning the car could be entirely powered by the supercapacitors in its body panels. After one full charge this car should be able to run up to 500 km, similar to a petrol powered car and more than double the current limit of an electric car.

The Future of Hybrids and Electrics - II

Self Protecting cars

Since many years, the trusty seat belts have been protecting the driver and the passengers with a high success rate. They provide the sole form of passive restraint in our cars. Due to some of its limitations, a new concept of inflated air bags were introduced in cars. Like seat belts, the concept of the airbag - a soft pillow to land against in a crash has been around for many years.

We know that moving objects have momentum. Unless an outside force acts on an object, the object will continue to move at its present speed and direction. Cars consist of several objects, including the vehicle itself, loose object and of course the passengers. If these objects are not restrained, they will continue moving at whatever speed the car is traveling at, even if the car is stopped by a collision. When a car crashes, the force required to stop an object is very great because the car's momentum has changed instantly while the passengers' has not and hence there is not much time to work with. The goal of any supplemental restraint system is to help stop the passenger while doing as little damage to him or her as possible. Basically this is what an airbag does to the passengers and the driver. It slows down the passengers' speed to zero with little or no damage.

Airbags in the future will not only protect the people but also the car

Ever since airbags were added to vehicles, they've continued to make their way around the inside of our vehicles. We now have curtain airbags, side airbags, knee airbags, seat belts airbags and even ones that deploy under us. Apart from airbags that protect people inside the car, airbags have been devised by Volvo that protect pedestrians outside who get hit by the car.

To take the technology to a whole new level, Mercedes is working on a new way to use airbags that moves them away from a passive safety measure and makes it part of an active safety system. They are experimenting with airbags that deploy from underneath the car that will help stop or at least slow down a vehicle before a crash. The airbags are part of the overall active safety system and deploy when sensors determine that an impact is inevitable. The bags have a friction coating that helps slow the car down and can double the stopping power of the vehicle. The bags also lift the vehicle up to eight centimetres, which counters the car's dipping motion during hand braking, improves bumper-to-bumper contact and helps prevent passengers from sliding under seat belts during a collision. This lift also helps in removing the contact of the tyres with the road and hence resulting in loss of speed.
Positioned between the front axle carrier and underbody panelling, it only triggers during emergency braking if the car's sensors signal that a collision with a vehicle or obstruction ahead is inevitable. Protected by an aluminium and rubber or carbon-fibre shield, the bag improves wheeled braking power from a maximum of about 1g on a dry surface to around 2g, mitigating the effects of the collision.

The braking bag, which could be fitted to the next all-new generation of Mercedes cars within seven years, is being tested on the company's new S-class hybrid-based ESV (Experimental Safety Vehicle) 2009.

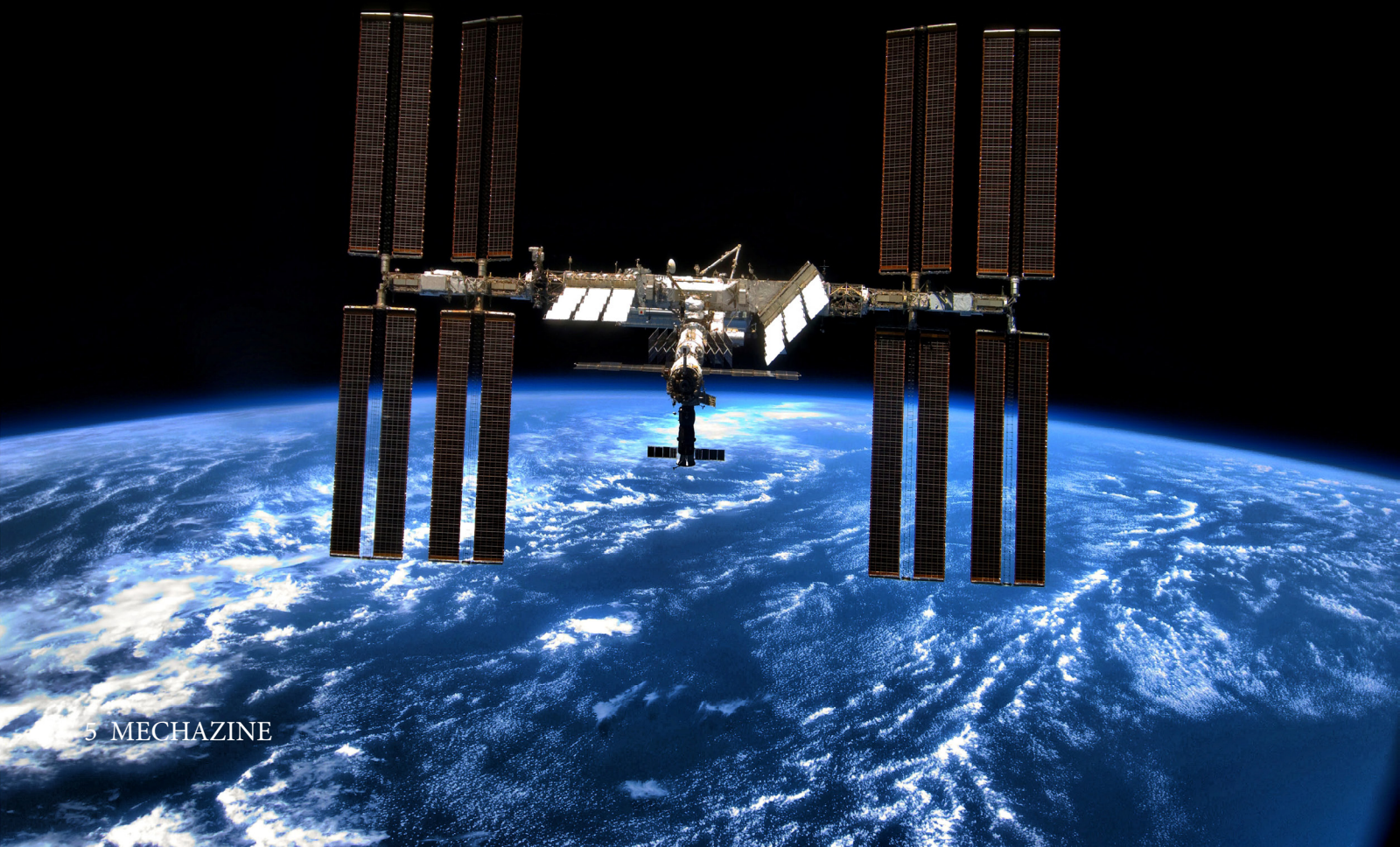
This kind of airbag has a great potential in the future because it uses the existing vehicle safety systems. With the current evolution of airbags and their pervasiveness within the automotive world, it wouldn't be a stretch to imagine future cars using airbags to not only protect passengers, but to actually stop cars as well. These kinds of technologies are the stepping stones to an accident free driving pleasure.

Ashwath Ramesh
S6 ME

A JOURNEY THROUGH ISS

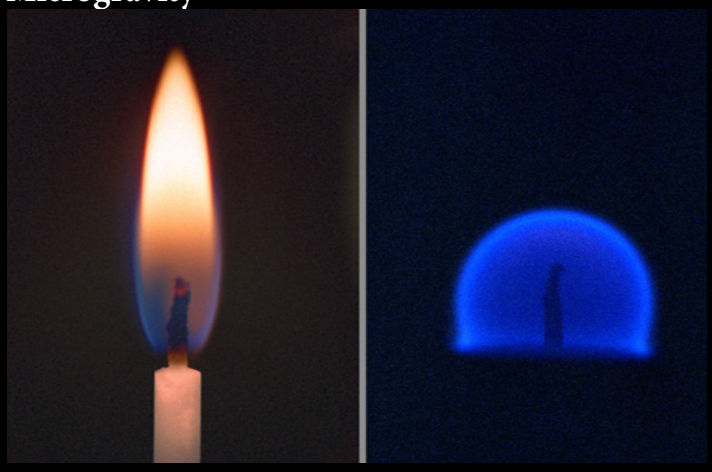
JEFIN JACOB
S8 ME

'Long ago man dreamt of the flying. He dreamt of watching the stars. But I think time has taken care of all his wishes. Its time to float weightless watching the world pour by through the big bay of the SPACE STATION playing a guitar. Just a tremendous place to think about when we are in history."



The largest artificial satellite ever put in space. With its first component launched in 1998. The ISS consisting of pressurized modules, external trusses, solar arrays and various other components. Launched by the American space shuttles and the Russian Proton and Soyuz rockets. The ISS provides a platform for the microgravity and the space environment research laboratories. The station has been in continuous use for 13 years and 86 days. Since the American shuttle program ended in 2011 Soyuz rockets became the carrier vehicle for the astronauts to the ISS. The ISS programme is a joint project among five participating space agencies: NASA, Roskosmos, JAXA, ESA, and CSA.The station is divided into two sections, the Russian Orbital Segment (ROS) and the United States Orbital Segment (USOS), which is shared by many nations. The ISS maintains an orbit with an altitude of between 330 km (205 mi) and 435 km (270 mi) by means of reboost manoeuvres using the engines of the Zvezda module or visiting spacecraft. It completes 15.410 orbits per day. The ISS is funded until 2024, and may operate until 2028.The Russian Federal Space Agency, Roskosmos (RKA) has proposed using the ISS to commission modules for a new space station, called OPSEK, before the remainder of the ISS is deorbited. ISS is the ninth space station to be inhabited by crews, following the Soviet and later Russian Salyut, Almaz, and Mir stations, and Skylab from the US.

Microgravity



The Earth's gravity is only slightly weaker at the altitude of the ISS than at the surface. However, objects in orbit are in a continuous state resulting in an apparent state of weightlessness. This perceived weightlessness is disturbed by five separate effect

•Drag from the residual atmosphere; when the ISS enters the Earth's shadow, the main solar panels are rotated to minimise this aerodynamic drag.

•Vibration from movements of mechanical systems and the crew.

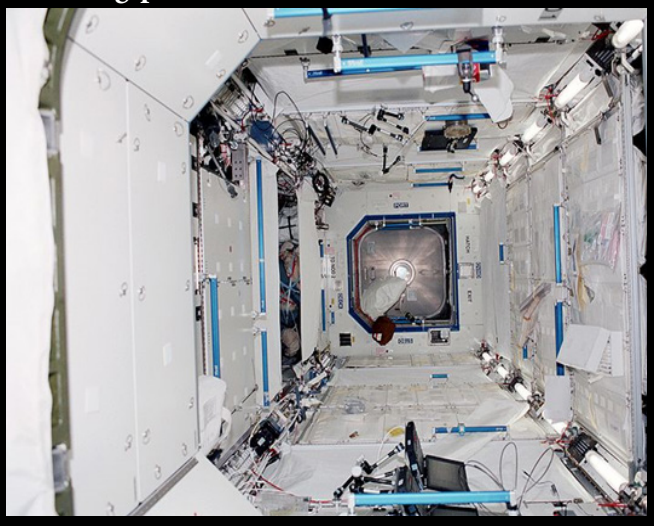
•Thruster firings for attitude or orbital changes.

• Gravity-gradient effects, also known as tidal effects.

Items at different locations within the ISS would, if not attached to the, these items experience small forces that keep the station moving as a rigid body. Station, follow slightly different orbits.

Destiny

Is the primary research facility for United States payloads aboard the ISS. In 2011, NASA solicited proposals for a not-for-profit group to manage all American science on the station which does not relate to manned exploration. The module houses 24 International Standard Payload Racks, some of which are used for environmental systems and crew daily living equipment. Destiny also serves as the mounting point for the station's Truss Structure.



Cupola

Is a seven window observatory, used to view Earth and docking spacecraft. Its name derives from the Italian word cupola, which means "dome". The Cupola project was started by NASA and Boeing, but cancelled due to budget cuts. A barter agreement between NASA and the ESA resulted in the Cupola's development being resumed in 1998 by the ESA. It features 7 windows, with a 80-centimetre (31 in) round window, the largest window on the station. The distinctive design has been compared to the 'turret' of the fictitious Millennium Falcon from the motion picture Star Wars the original prop lightsaber used by actor Mark Hamill as Luke Skywalker in the 1977 film was flown to the station in 2007 and the Falcon rockets

Lifesupport

The critical systems are the atmosphere control system, the water supply system, the food supply facilities, the sanitation and hygiene equipment, and fire detection and suppression equipment. The Russian orbital segment's life support systems are contained in the Service Module Zvezda. Some of these systems are supplemented by equipment in the USOS. The MLM Nauka laboratory has a complete set of life support systems.

Atmospheric control

The atmosphere on board the ISS is similar to the Earth's. Normal air pressure on the ISS is 101.3 kPa (14.7 psi) the same as at sea level on Earth. An Earth-like atmosphere offers benefits for crew comfort, and is much safer than the alternative, a pure oxygen atmosphere, because of the increased risk of a fire such as that responsible for the deaths of the Apollo 1 crew. Earth-like atmospheric conditions have been maintained on all Russian and Soviet spacecraft. The Elektron system aboard Zvezda and a similar system in Destiny generate oxygen aboard the station. The crew has a backup option in the form of bottled oxygen and Solid Fuel Oxygen Generation (SFOG) canisters, a chemical oxygen generator system. Carbon dioxide is removed from the air by the Vozdukh system in Zvezda. Other by-products of human metabolism, such as methane from the intestines and ammonia from sweat, are removed by activated charcoal filters.

Expeditions and private flights:

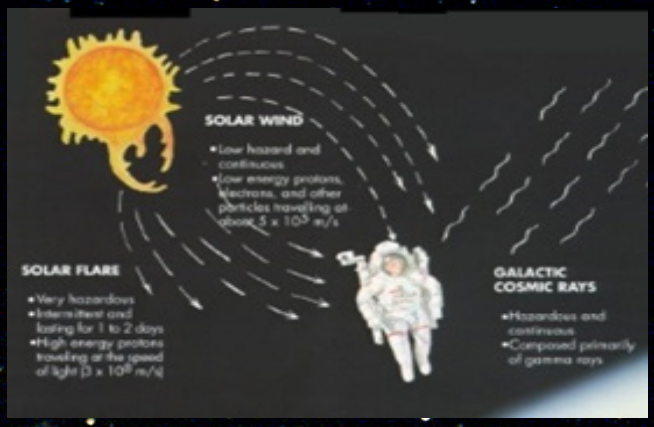
(Soyuz tm-31 transported to launch pad)

Each permanent crew is given an expedition number. Expeditions run up to six months, from launch until undocking, an 'increment' covers the same time period, but includes cargo ships and all activities. Expeditions 1 to 6 consisted of 3 person crews, Expeditions 7 to 12 were reduced to the safe minimum of two following the destruction of the NASA Shuttle Columbia Sergei Krikalev, member of Expedition 1 and Commander of Expedition 11 has spent more time in space than anyone else, a total of 803 days and 9 hours and 39 minutes. His awards include the Order of Lenin, Hero of the Soviet Union, Hero of the Russian Federation, and 4 NASA medals. On 16 August 2005 at 1:44 am EDT he passed the record of 748 days held by Sergei Avdeyev, who had 'time travelled' 1/50th of a second into the future on board MIR. He participated in psychosocial experiment SFINCSS-99 (Simulation of Flight of International Crew on Space Station), which examined inter-cultural and other stress factors affecting integration of crew in preparation for the ISS spaceflights. Commander Michael Fincke has spent a total of 382 days in space – more than any other American astronaut.

Crew health and safety

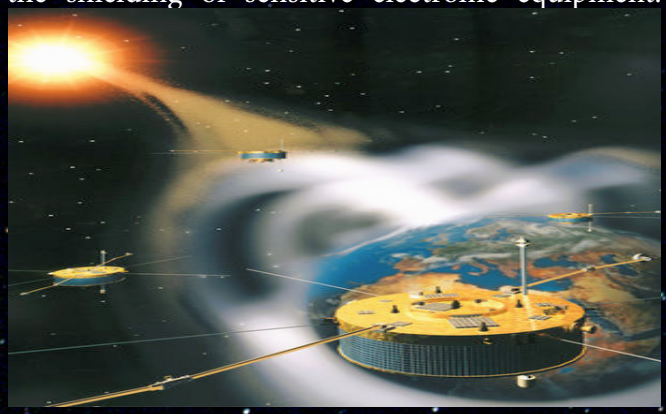
Radiation

The ISS is partially protected from the space environment by the Earth's magnetic field. From an average distance of about 70,000 km, depending on Solar activity, the magnetosphere begins to deflect solar wind around the Earth and ISS. However, solar flares are still a hazard to the crew, who may receive only a few minutes warning. The crew of Expedition 10 took shelter as a precaution in 2005 in a more heavily shielded part of the ROS designed for this purpose during the initial 'proton storm' of an X-3 class solar flare, but without the limited protection of the Earth's magnetosphere, interplanetary manned missions are especially vulnerable.



Surviving extreme conditions on space

Temperature in the station are provided to support human life. While in the space it can vary upto -1500 to 4000 c. Space is one of the most extreme environments imaginable. Above the insulating atmosphere of the Earth, spacecraft are subjected to extremes of temperature, both hot and cold, and a significantly increased threat of radiation damage. Either of these phenomena can shatter delicate pieces of equipment and so engineers always build a thermal and structural model of the spacecraft and test it. They simulate the conditions of launch using the vibration table and acoustic chamber at ESA's European Space Technology Centre (ESTEC) in The Netherlands. Temperatures in space can range from the extremely cold, hundreds of degrees below freezing, to many hundreds of degrees above – especially if a spacecraft ventures close to the Sun. Although there is no air in space, energy is carried by radiation,usually coming from the Sun, that causes heating when it is absorbed by spacecraft, planets or other celestial bodies. Depending on where in space they intend a vehicle to operate, engineers build in either cooling systems or insulators However, in the case of ESA's comet-chaser Rosetta, the spacecraft must first venture into the heat of the inner Solar System, before heading away into the freezing outer Solar System. Engineers designed a system of 'louvres' that fit over the spacecraft's radiator panels. When Rosetta is in the inner Solar System, the louvres swing open, allowing the radiators to expel excess heat into space. Later, in the outer Solar System, the louvres shut, helping to retain heat inside. Ensuring that integrated circuits and computers can work in the radiation environment of space requires the shielding of sensitive electronic equipment.



Cluster

Radiation in space can be split into 'trapped' and 'transient' types. The trapped particles are the subatomic particles, mainly protons and electrons, trapped by Earth's magnetic field which creates the so-called Van Allen radiation belts around our planet. The transient radiation is mainly composed of protons and cosmic rays that constantly stream through space and are enhanced during the magnetic storms on the Sun known as 'solar flares'. Meteor showers can also damage spacecraft. The little dust particles that cause us to see 'shooting stars' travel through space at several kilometres per second and can have the effect of 'sand blasting' large arrays of vital solar panels.

"ISS" isn't its scale, its suspense, or its sense of wonder; it's that, in its heart, it is not primarily about astronauts, or space, or even a specific catastrophe. At times it plays like a high-tech version of shipwreck or wilderness survival story that happens to take place among the stars.

TRANSIENT MATERIALS

ASHIN CHERIAN JOSEPH
S1S2

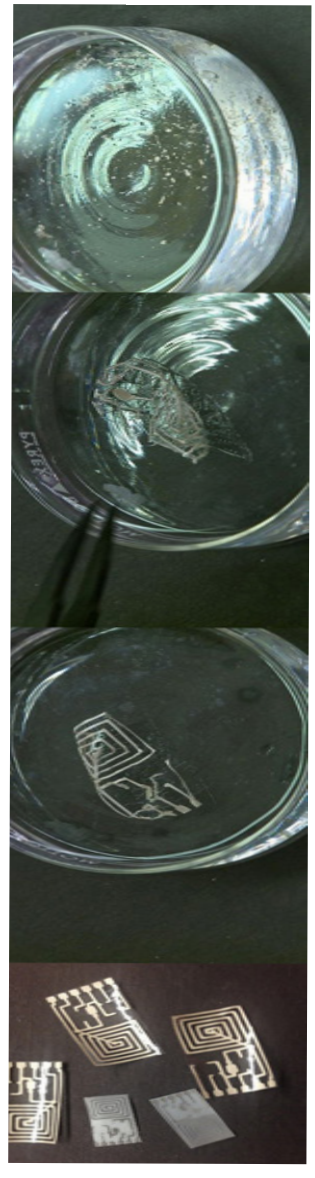
A research team is developing "transient materials" and "transient electronics" that can quickly and completely melt away when a trigger is activated. That could mean that one day you could send out a signal to destroy a lost credit card, or when soldiers are wounded, their electronic devices could be remotely triggered to melt away, securing sensitive military information. The field of study is very new, but progress is being made.

A medical device, once its job is done, could harmlessly melt away inside a person's body. Or, a military device could collect and send its data and then dissolve away, leaving no trace of an intelligence mission. Or, an environmental sensor could collect climate information, then wash away in the rain.
It's a new way of looking at electronics: "You don't expect your cell phone to dissolve someday, right?" said Reza Montazami, an Iowa State University assistant professor of mechanical envv gineering. "The resistors, capacitors and electronics, you don't expect everything to dissolve in such a manner that there's no trace of it."
But Montazami thinks it can happen and is developing the necessary materials.

He calls the technology "transient materials" or "transient electronics." The materials are special polymers designed to quickly and completely melt away when a trigger is activated. It's a fairly new field of study and Montazami says he's making progress.

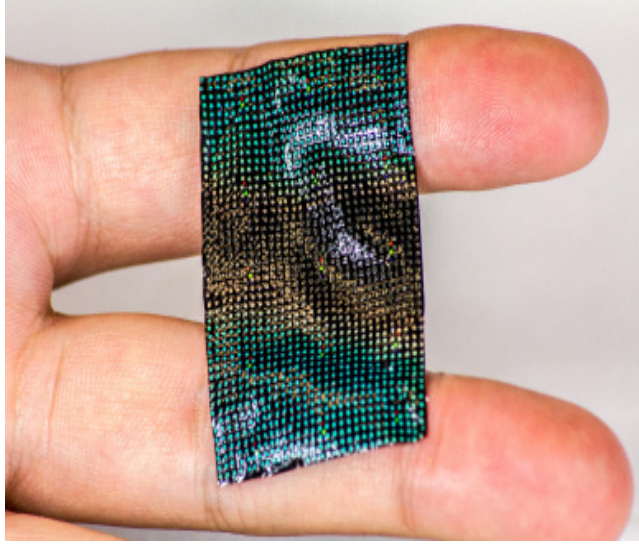
The research team he's leading, for example, is developing degradable polymer composite materials that are suitable platforms for electronic components. The team has also built and tested a degradable antenna capable of data transmission.

The team presented some of its research results at the recent meeting of the American Chemical Society in Dallas. And, a paper describing



some of the team's work, "Study of Physically Transient Insulating Materials as a Potential Platform for Transient Electronics and Bio-electronics," has just been published online by the journal Advanced Functional Materials.

The paper focuses on the precise control of the degradation rate of polymer composite materials developed for transient electronics. Investigation of electronic devices based on transient materials (transient electronics) is a new and rarely addressed technology with paramount potentials in both medical and military applications," the researchers wrote in the paper.



Epidermal Photonics System

To demonstrate that potential, Montazami played a video showing a blue light-emitting diode mounted on a clear polymer composite base with the electrical leads embedded inside. Add a drop of water and the base and grades what little is left.

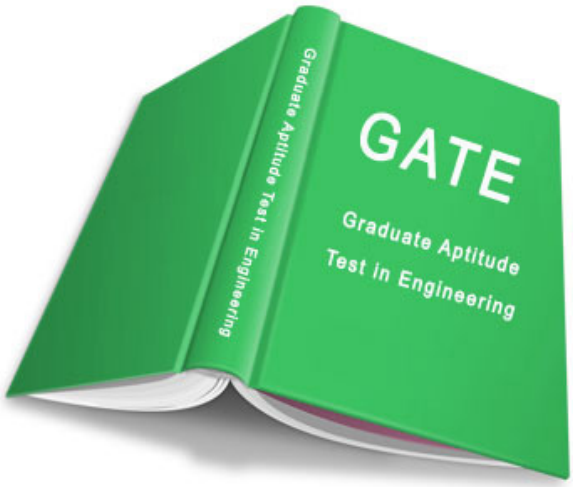
A medical device, once its job is done, could harmlessly melt away inside a person's body. Or, a military device could collect and send its data and then dissolve away, leaving no trace of an intelligence mission.

The researchers have developed and tested transient resistors and capacitors. They're working on transient LED and transistor technology, said Montazami, who started the research as a way to connect his background in solid-state physics and materials science with applied work in mechanical engineering.

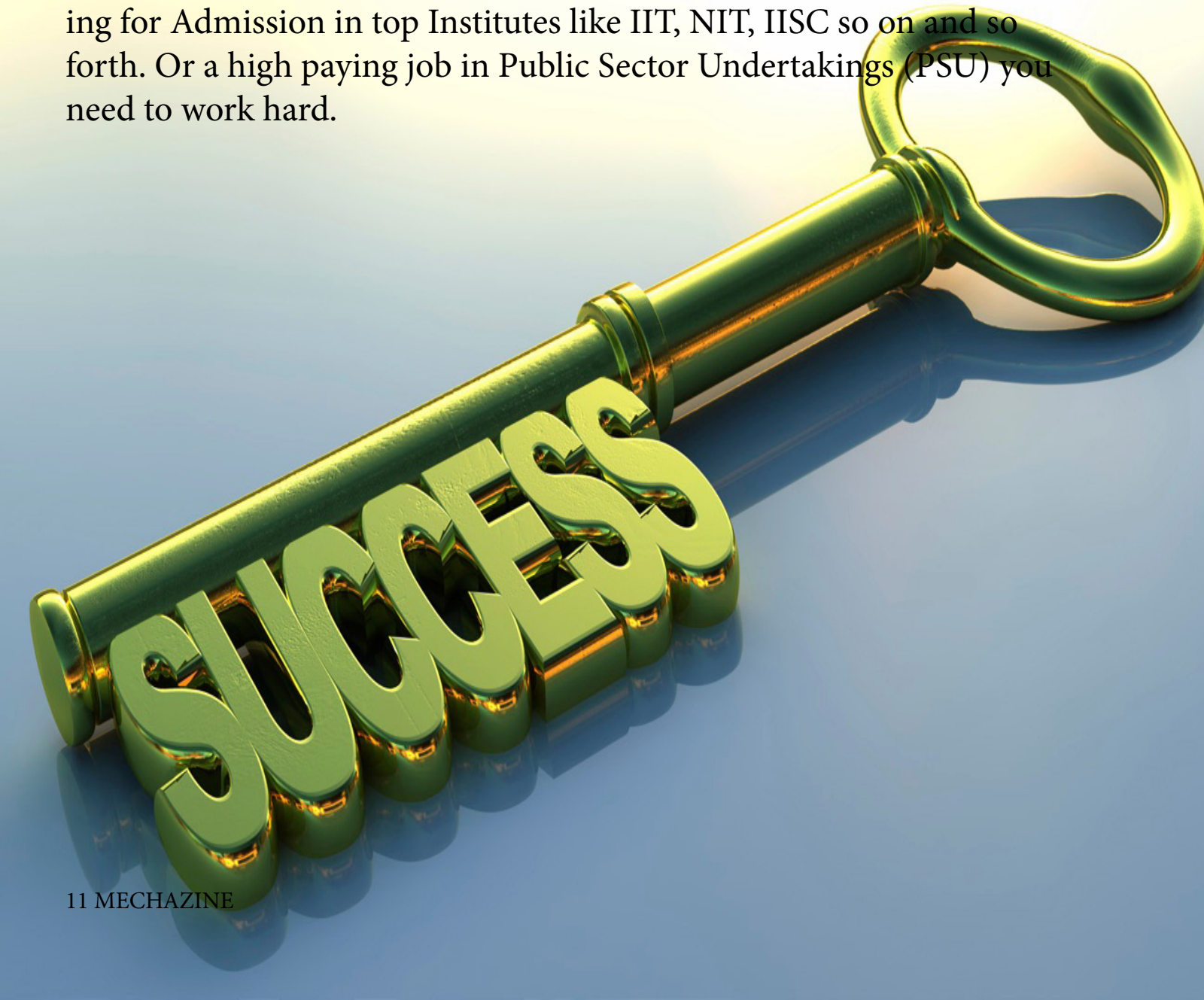
As the technology develops, Montazami sees more and more potential for the commercial application of transient materials.

Just think, he said, if you lose your credit card, you could send out a signal that causes the card to self-destruct. Or, sensors programmed to degrade over certain times and temperatures could be stored with food. When the sensors degrade and stop sending a signal, that food is no longer fresh. Or, when soldiers are wounded, their electronic devices could be remotely triggered to melt away, securing sensitive military information.

GATE



GATE tips & tricks for Mechanical Engineering - The Graduate Admission Test in Engineering (GATE) is an all-India level examination for aspirants who are interested in pursuing Masters/Direct PhD in India or Abroad. More than 15 lac students have applied in the year 2014. These figures send message clear and loud that if you are aspiring for Admission in top Institutes like IIT, NIT, IISC so on and so forth. Or a high paying job in Public Sector Undertakings (PSU) you need to work hard.



Normally GATE exam consists of those questions which are mostly related to research done at Master Level i.e. M.Tech or M.E Level. So, it is very important to get ready for the preparation of those subjects on which complete M.Tech or M.E is based. In case of Mechanical Engineering, One should prepare for most of the following important subjects.

1. Mechanics of Solids (Engineering Mechanics + Strength of the Material)
2. Thermal engineering which includes Fluid mechanics which is most important subject of thermal engineering specialization in M.Tech or M.E. Second are thermodynamics, Heat and mass transfer and refrigeration and air conditioning
3.Theory of Machines or Dynamics of Machines
4.Machine design
5.Manufacturingengineering

So you cannot miss important subjects in GATE mechanical preparation. You need to look for the basic concepts while preparing for the GATE.

Before we start tips, Here are 2 mantras to keep in mind:-

1. If you are a student who has studied in an average college in your under graduation (BE/B Tech) and always have been criticized or cribbed about your college, THIS IS YOUR OPPURTUNITY.! Give it a good shot and prove you are worth of cracking GATE .
2. Don't feel disappointed if near and dear ones don't consider you worthy of cracking GATE. If you really want to do it, then just DO IT.

The first Leap!

Firstly, start believing that GATE is your goal. Till the time you don't really believe that GATE is your goal all the planning and management will turn out to be waste.

The first step is to ensure that you have read all the information regarding the exam, syllabus, eligibility etc.

according to syllabus start your planning and preparation.

Use Proper Resource and Books

Selection of books is very crucial. Ensure you have opted for right book and material

consult with your faculty at your coaching institute as well.

Buy previous year question papers with solution so that you get an idea of the pattern and you can set up your mind according to that.

*Plan your study well

GATE covers the syllabus of 3-4 years of engineering, so some has higher weight age than other. Keep the syllabus of GATE handy and plan your time table accordingly.

Keep in mind that even if a subject has lower weight age compared to other, it also contributes the paper.

Make concise notes and ready to revise material

Always keep short notes of each chapter which you can revise often.

*Test yourself frequently

Once your cover a topic or subject , refer to GATE previous year question papers.

*Analyze where you stand in mock test

if you have enrolled for some test series, it will help you to have a regular check mechanism of where you stand.

*Complete preparation on time

One of the important thing is that to ensure you complete your syllabus on time.

*Time management- the success mantra

Time Management sounds like an easy task but it is very complex. Make a month wise time table that is in which month which topic to complete.

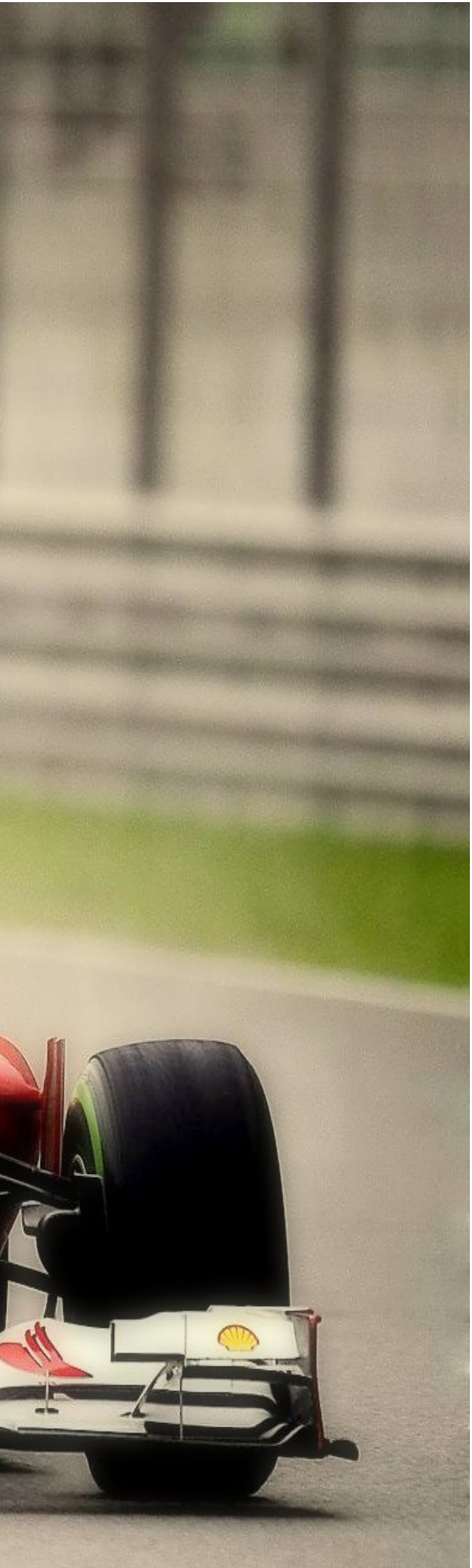
*Cut off time for less important activities

Stop using the internet beyond 2 hours a day because it is more than enough to track any exam updates.

Make the words: It is not tough to crack GATE!

All you need is a certain level of commitment and decisions.

F1 Legacy



Akshay Kurien
S6 me

The cars used in F1 championships are quite different from usual cars. Just go through these interesting facts on these cars and you will know how different both the versions are.;-

- Approximate 80,000 components come together to make an F1 car. The cars have to be assembled with cent per cent accuracy. If it were assembled 99.9% correctly, it would go on the track with 80 components wrongly placed.
- F1 car engines complete their life in about two hours of racing. Just compare this with normal engines which go on serving us faithfully for decent 20 years.
- When an F1 driver puts brakes on his car he experiences huge retardation or deceleration. It could be compared to a regular car driving through a brick wall at the speed of 300kmph.
- An F1 engine usually revs up to 18000 rpm. This means that the piston travels up and down 300 times a second. Road car engines rev up to 6000 rpm at max.
- Road car tyres can last 60 000 to 100 000 km. On the other hand, racing tyres are designed to last only 90 to 120 km.
- An F1 car can accelerate from 0 to 160 kph and decelerate back to 0 in just four seconds. Road cto last only 90 to 120 km.

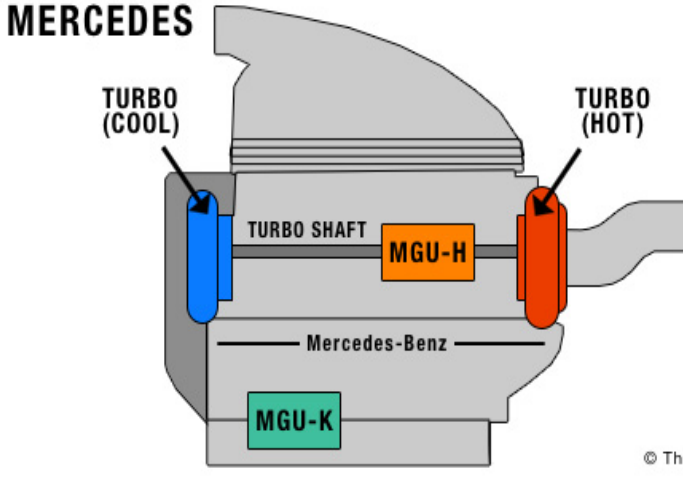
2014 onwards, the cars will be powered by avant-garde powertrain technology, with a powerful turbocharged internal combustion engine coupled to sophisticated energy recovery systems.

Energy efficiency will reach levels never seen in the sport before, with two types of energy propelling the cars. The internal combustion engine will produce power through consumption of traditional carbon-based fuel, while electrical energy will be harvested from exhaust and braking by two motor generator units. The two systems will work in harmony, with teams and drivers balancing the use of the two types of energy throughout the race.
The advent of this new technology means that the word 'engine' is no longer sufficient: instead the sport will refer to 'Power Units.'

Power Unit

A formula One car's power unit consists of a 1.6-litre turbocharged V6 engine which operates in conjunction with an Energy Recovery System (ERS). The engine must have six cylinders in a 90-degree formation, with two inlet and two exhaust valves per cylinder and a single turbocharger. They are rev-limited to 15,000rpm, have a fuel flow limit of 100 kilograms/hour and produce around 600bhp. They must also have a single tailpipe exhaust.

The other part of the power unit - ERS - provides an additional 160bhp or so per lap via two clever motor generator units (MGU) that convert mechanical and heat energy to electrical energy and vice versa.
The first MGU (known as MGU-K, where the K stands for kinetic) converts kinetic energy generated under braking into electricity. Under acceleration 120kW of this electricity, which is stored in batteries in the Energy Store (ES), can then be used to power the MGU-K which is connected to



the crankshaft of the engine and in turn helps propel the car.
The second MGU (known as MGU-H, where the H stands for heat), is connected to the turbocharger and converts heat energy from exhaust gases into electrical energy. The energy can then be used to power the MGU-K or be retained in the ES for subsequent use. In total, ERS has twice the

power of the pre-2014 KERS (120kW compared to 60kW, a maximum of 4MJ per lap compared to 0.4MJ per lap) and provide it for nearly ten times as long (approximately 33 seconds per lap as opposed to six).

For safety, each car is fitted with ERS status lights which warn marshals and mechanics of the car's electrical safety status when it is stopped or in the pits. If the car is safe, the lights - which are situated on the roll hoop and the rear tail lamp - will glow green; if not, they glow rEd. The lights must remain on for 15 minutes after the power unit has been switched off.

The overall weight of the power unit must be a minimum of 145kg. The ES must be installed wholly within the survival cell and must weigh between 20kg and 25kg.

The materials used in the manufacture of the engine and its components are strictly controlled by the regulations. The crankcase and cylinder block must be made of cast or wrought aluminium alloys - the use of composite materials is not allowed. The crankshaft and camshafts must be made from an iron-based alloy, pistons from an aluminium alloy and valves from alloys based on iron, nickel, cobalt or titanium.

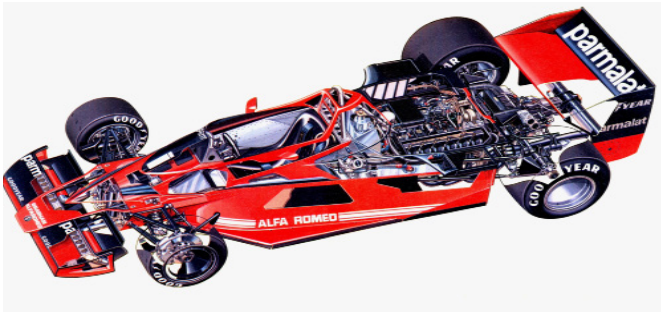
Formula One cars do not have their own, onboard

AERODYNAMICS

A modern Formula One car has almost as much in common with a jet fighter as it does with an ordinary road car. Aerodynamics have become key to success in the sport and teams spend tens of millions of dollars on research and development in the field each year.

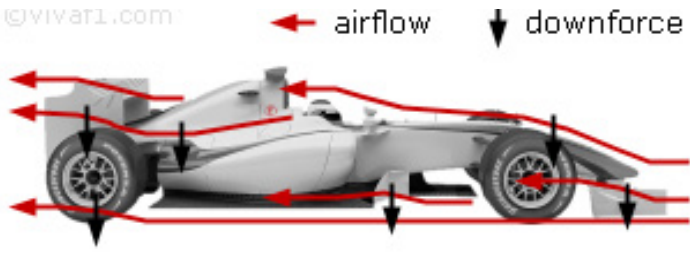
The aerodynamic designer has two primary concerns: the creation of downforce, to help push the car's tyres onto the track and improve cornering forces; and minimising the drag that gets caused by turbulence and acts to slow the car down.

Several teams started to experiment with the now familiar wings in the late 1960s. Race car wings operate on exactly the same principle as aircraft wings, only in reverse. Air flows at different speeds over the two sides of the wing (by having to travel different distances over its contours) and this creates a difference in pressure, a physical rule



known as Bernoulli's Principle. As this pressure tries to balance, the wing tries to move in the direction of the low pressure. Planes use their wings to create cidents, and for the 1970 season regulations were introduced to limit the size and location of wings. Evolved over time, those rules still hold largely true today.

By the mid 1970s 'ground effect' downforce had been discovered. Lotus engineers found out that the entire car could be made to act like a wing

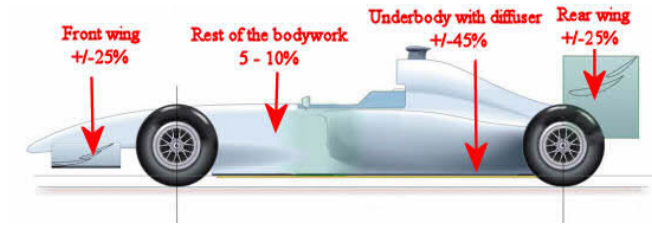


by the creation of a giant wing on its underside which would help to suck it to the road. The ultimate example of this thinking was the Brabham BT46B, designed by Gordon Murray, which actually used a cooling fan to extract air from the skirted area under the car, creating enormous downforce. After technical challenges from other teams it was withdrawn after a single race. And rule changes followed to limit the benefits of 'ground effects' - firstly a ban on the skirts used to contain the low pressure area, later a requirement for a 'stepped floor'.

Despite the full-sized wind tunnels and vast computing power used by the aerodynamic departments of most teams, the fundamental principles of Formula One aerodynamics still apply: to create the maximum amount of downforce for the minimal amount of drag. The primary wings mounted front and rear are fitted with different profiles depending on the downforce requirements of a particular track. Tight, slow circuits like Monaco require very aggressive wing profiles - you will see that cars run two separate 'blades' of 'elements' on the rear wings (two is the maximum permitted). In contrast, high-speed circuits like Monza see the cars stripped of as much wing as possible, to reduce drag and increase speed on the long straights.

Every single surface of a modern Formula One car, from the shape of the suspension links to that of the driver's helmet - has its aerodynamic effects considered. Disrupted air, where the flow 'separates' from the body, creates turbulence which creates drag - which slows the car down. Look at a recent car and you will see that almost as much effort has been spent reducing drag as increasing downforce - from the vertical end-plates fitzted to wings to prevent vortices forming to the diffuser plates mounted low at the back, which help to re-equalise pressure of the faster-flowing air that has passed under the car and would otherwise create a low-pressure 'balloon' dragging at the back. 'slippery', as a good supply of airflow has to be ensured to help dissipate the vast amounts of heat produced by a modern Formula One engine.

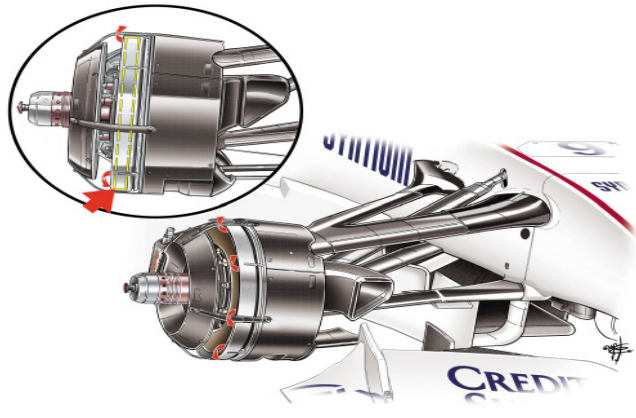
In recent years most Formula One teams have tried to emulate Ferrari's 'narrow waist' design, where the rear of the car is made as narrow and low as possible. This reduces drag and maximises the amount of air available to the rear wing. The 'barge boards' fitted to the sides of cars also helped to shape the flow of the air and minimise the amount of turbulence.



Suspension

The suspension of a modern Formula One car forms the critical interface between the different elements that work together to produce its performance. Suspension is what harnesses the power of the engine, the downforce created by the wings and aerodynamic pack and the grip of the tyres, and allows them all to be combined effectively and translated into a fast on-track package.

Unlike road cars, occupant comfort does not enter the equation - spring and damper rates are very firm to ensure the impact of hitting bumps and kerbs is defused as quickly as possible. The spring absorbs the energy of the impact, the shock absorber releases it on the return stroke, and prevents an oscillating force from building up.



Think in terms of catching a ball rather than letting it bounce.

Following the ban on computer-controlled 'active' suspension in the 1990s, all of the Formula One car's suspension functions must be carried out without electronic intervention. The cars feature 'multi-link' suspension front and rear, broadly equivalent to the double wishbone layout of some roadcars, with unequal length suspension arms top and bottom to allow the best possible control of the camber angle the wheel takes during cor in terms of catching a ball rather than letting it bounce.

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Unlike road cars, Formula One springs are no longer mounted directly to the suspension arms, instead being operated remotely via push-rods and bell cranks which (like the lobes of a camshaft) allow for variable rate springing - softer initial compliance becoming stronger as the spring is compressed further. The suspension links themselves are now made out of carbon fibre to add strength and save weight. This is vital to reduce 'unsprung mass' - the weight of components between the springs and the surface of the track.

Modern Formula One suspension is minutely adjustable. Initial set-up for a track will be made according to weather conditions (wet weather settings are far softer) and experience from previous years, which will determine basic spring and damper settings. These rates can then be altered according to driver preference and tyre performance, as can the suspension geometry under specific circumstances. Set-up depends on the aerodynamic requirements of the track, weather conditions and driver preference for understeer or oversteer - this being nothing more complicated than whether the front or back of the car loses grip first at the limits of adhesion.

STEERING WHEEL

Formula One drivers have no spare concentration for operating fiddly controls, or trying to look at small, hidden gauges. Hence the controls and instrumentation for modern Formula One cars have almost entirely migrated to the steering wheel itself - the critical interface between the driver and the car.

Early Formula One cars used steering wheels taken directly from road cars. They were normally made from wood (necessitating the use of driving gloves), and in the absence of packaging constraints they tended to be made as large a diameter as possible, to reduce the effort needed to turn. As cars grew progressively lower and cockpits narrower throughout the 1960s and 1970s, steering wheels became smaller, so as to fit into the more compact space available.

The introduction of semi-automatic gearchanges via the now familiar 'paddles' marked the beginning of the move to concentrate controls as close to the driver's fingers as possible. The first buttons to appear on the face of the steering wheel were the 'neutral' button (vital for taking the car out of gear in the event of a spin), and the on-board radio system's push-to-talk button.

As time went on the trend continued. Excepting the throttle and brake pedals, few Formula One cars have any controls other than those on the face of the wheel. Buttons tend to be used for 'on/off' functions, such as engaging the pit-lane speed limiter system, while rotary controls govern functions with multiple settings, such as engine maps, fuel mixture and even the car's front-to-rear brake bias - all functions the driver might wish to alter to take account of changing conditions during the race. Among the most recent additions are controls relating to the car's energy recovery systems (ERS) and the drag reduction system (DRS) on the rear wing.

The steering wheel is also used to house instrumentation, normally via a multi-function LCD display screen and - more visibly- the ultra-bright 'change up' lights that tell the driver the perfect time for the optimum gearshift. Race control can also communicate with the driver via a

compulsory, steering-wheel mounted GPS marshalling system. This displays warning lights, with colours corresponding to the marshals' flags, to alert drivers to approaching hazards, such as an accident, on the track ahead.

The steering wheels are not designed to make more than three quarters of a turn of lock in total, so there is no need for a continuous rim, instead there are just two 'cut outs' for the driver's hands.

One of the most technically complicated parts of the whole Formula One car is the snap-on connector that joins the wheel to the steering column. This has to be tough enough to take the steering forces, but it also provides the electrical connections between the controls and the car itself. The FIA technical regulations state that the driver must be able to get out of the car within five seconds, removing nothing except the steering wheel - so rapid release is vitally important.

Formula One cars now run with power assisted steering, reducing the forces that must be transmitted by the steering wheel. This has enabled designers to continue with the trend of reducing the steering wheel size, with the typical item now being about half the diameter of that of a normal road car.

OVERTAKING AND DRS

As only one driver can ever sit on pole position for a race, and the entire grid wants to finish on the top step of the podium, overtaking is of vital importance to the business of racing. Simplified to its most basic form overtaking is nothing more than gaining track position by getting past an opponent.

This can be done at the very start of a Grand Prix, during the dash towards the first corner - or during the race itself. Although you will often hear talk of cars 'overtaking in the pit lane' (meaning a car gaining track position through a better pit stop compared to a rival) this is a matter of race strategy. Most people regard overtaking as meaning cars passing each other on the track, during the race.

This sort of overtaking is brought about by a speed difference: the car behind going sufficiently faster than the car in front to make a pass. The higher the speed difference, the easier the overtake. As Formula One cars are typically very closely matched on performance and braking distances are comparatively short compared to other forms of racing, overtaking often requires a great deal of skill, commitment and courage.

A recent innovation that makes the driver's task slightly easier is the Drag Reduction System (DRS) overtaking aid. Within designated DRS activation zones, a driver within one second of a rival car may activate his DRS. This alters the angle of the rear wing flap, reducing drag and thereby providing a temporary speed advantage. To ensure that overtaking is not too easy, the length and location of DRS zones are carefully controlled.

Outside of the DRS zones, drivers can use several other methods to try to get past an opponent. One is to utilise an aerodynamic 'tow' from the car in front. This is achieved by moving into an opponent's slipstream – a pocket of low-pressure air behind a car through which the following driver can move more freely and gain a small speed advantage. However, whilst useful on straights, this aerodynamic effect is problematic in corners as the reduced airflow acting on the wings of the second car will dramatically decrease aerodynamic downforce, and hence grip - meaning that the car behind will typically be forced to drop back, or to pick a different cornering line in 'clean air'.

CATIA WORKSHOP

ROBOTICS WORKSHOP

AN AIRCRAFT FOR FUTURE

SYNERGY AIRCRAFT

The airplane is arguably the biggest single revolution in travel ever.No single invention has connected physical space like the plane. Yet, there's still much room for improvement in terms of cost, efficiency and comfort. With this in mind a team of U.S. designers is developing what they believe is a better solution for flying: the Synergy aircraft.

"Largest practical fuel economy breakthrough in history."

JITHIN JOSE
S6 ME

Synergy is an airplane designed to safely fly one to six people directly from town to town, in less time and at less cost than airliners or automobiles. Its innovative technologies provide the key to economical regional transportation in the speed range between the supercar and the airliner. It is a seed-stage aircraft development company in Kalispell, Mont. Headed by CEO and designer John McGinnis, the company was created around the design of a small, efficient personal aircraft.

Something known since the 1950s, yet hardly acknowledged, is that all prior aircraft waste enormous amounts of energy to fly in the mid-subsonic speed range. The problem is aerodynamic drag.

The first key is its distinctive double boxtail wing-becomes-tail configuration, which provides outstanding stability and control while reducing the dominant cause of drag at low speeds, called "induced drag". Unlike boxwing designs, the twin horizontal tails -above and behind each wingtip- aren't 'wings' to make more lift. In fact, these control surfaces actually create a downward force most of the time. This downward force (the right amount, in the right place) acts against the 'induced drag' so well that it actually reduces the total drag, a lot like a sailplane reduces its total drag by adding wingspan. Some think of it like origami: folding up the low-drag airfoil surfaces of a long wing in 3-D space, so as to achieve stable, high-speed flight

GENERAL CHARACTERISTICS

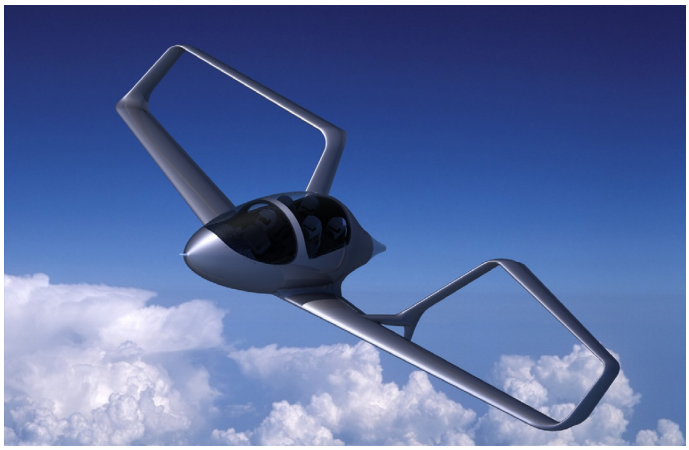
* Crew: 1
* Capacity: 4 passengers
* Length: 21 ft (6.4 m)
* Wingspan: 32 ft (9.8 m)
* Wing area: 144.6 sq ft (13.43 m2)
* Empty weight: 1,650 lb (748 kg)
* Gross weight: 3,100 lb (1,406 kg)
* Powerplant: 1 × DeltaHawk DH200 liq uid-cooled V-4 two-stroke diesel engine, 200 hp (150 kW)

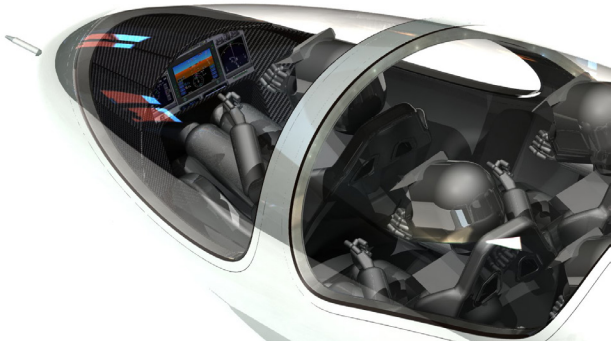
Performance

* Range: 1,726 mi; 2,778 km (1,500 nmi) plus reserve
* Wing loading: 23.2 lb/sq ft (113 kg/m2)

As a result of all the drag reduction, McGinnis and team claim that the plane is 10 times more fuel efficient than the average small jet and 10 times less costly, calling it the "largest practical fuel economy breakthrough in history." Synergy also has built-in versatility in that it can fly farther than existing craft and land at slower speeds at small airfields. In terms of motivation, Synergy can be flown with jet engines but is optimally configured with a multi-blade turboprop engine.

Synergy is meant to be a small, quiet, fuel-efficient personal aircraft that can seat five to seven people. It features a unique double box-tail configuration designed to reduce drag without greater wingspan so that it can achieve higher speeds without reducing payloads. It is the team's hope that one day, Synergy-style aircraft will become a viable, affordable option for direct regional transportation.





Though the company was slated to compete in September 2011, engine delays and funding challenges prevented them from completing the aircraft in time. Instead, they exhibited a quarter-scale model at the expo. Synergy's sleek, unusual design attracted a lot of media attention and interested enthusiasts. Development was started in 2010 to develop the Synergy as a future kit airplane. The Synergy is the first aircraft that was designed to use the 200 hp (149 kW) DeltaHawk V-4 engine. An electric-powered 1/4 scale version of the aircraft has been built and flown via radio control.

Existing personal airplanes are extremely expensive, incredibly cramped, noisy gas guzzlers; most of them three decades old. On the other hand, they're powerful time machines; indispensable to modern business and a lot of fun to fly.John McGinnis believes ordinary families could afford it and they might even fly themselves without even having to go to the airport. He also added Synergy could be quieter, safer and far greater fuel economy than any other aircraft ever built.

EXPLORING TIME

"TIME TRAVEL MAY BE POSSIBLE BUT IT IS BEYOND OUR CURRENT TECHNOLOGICAL CAPABILITIES."

EDWIN PAUL
S6 ME

When you think of time travel what comes to mind?
Doctor Who hurtling through the centuries, hitting the controls inside the Tardis like some kind of metaphysical pinball machine?
Or does it raise images of time-flying contraptions built by Victorians in velvet smoking jackets? Or time machines made from souped-up sports cars like in the Back to the Future movies?
But could it ever really happen?

The probability of time travel is being investigated by academics at the University of Birmingham, one aspect of an international research program into the nature of time involving universities in Australia, the United States, Germany, the Netherlands and Turkey.

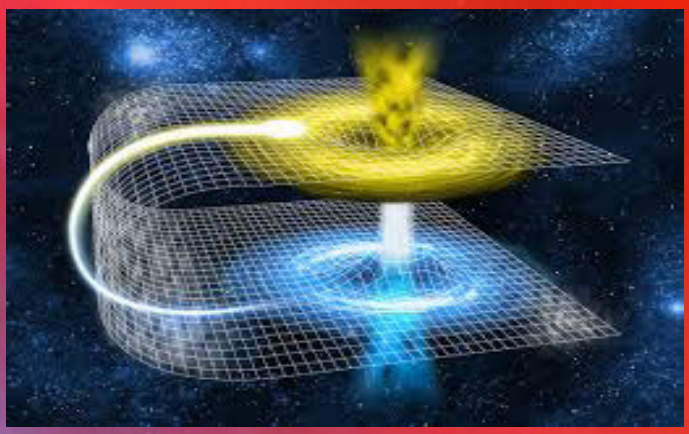
THE FOURTH DIMENSION

First, though, you have to get your head around the notion that time is a dimension, just like width, height and length. Hawking uses the example of driving in your car: You go forward. That's one direction. You turn left or right, that's a second. You journey up a mountain road, that's a third. The fourth dimension is time. "Time travel movies often feature a vast, energy-hungry machine. The machine creates a path through the fourth dimension, a tunnel through time. A time traveler, a brave, perhaps foolhardy individual, prepared for who knows what, steps into the time tunnel and emerges who knows when. The concept may be far-fetched, and the reality may be very different from this, but the idea itself is not so crazy," Hawking writes.

WORM HOLES

A wormhole is a hypothetical topological feature that would fundamentally be a shortcut through space-time. A wormhole is much like a tunnel with two ends, each in separate points in space-time. Einstein suggested the theoretical existence of "bridges" through time and space – often referred to as wormholes. His theory has been further developed by numerous physicists including Stephen Hawking and Kip Thorne. The basic idea if you're very, very optimistic is that if you fiddle with the wormhole openings, you can make it not only a shortcut from a point in space to another point in space, but a shortcut from one moment in time to another moment in time.

Unfortunately, no wormhole has ever been discovered, and even if it was, it would be far too small for scientists to manipulate for the purposes of time travel – measuring just a billion-trillion-trillionth of a centimeter across. They also pose a significant risk, bringing with them the threat of sudden collapse, high levels of radiation and contact with dangerous exotic matter.



COSMIC STRING

According to current hypotheses, a cosmic string is a giant vibrating strand or closed loop of matter; it is almost like a black hole, but long and thin, rather than a point or sphere. Cosmic strings may have been produced by gravitational shifts in the early universe. They could be envisioned as "creases" left in an otherwise smooth transition from the initial phases of cosmic evolution. They might also be described as "wrinkles" in the texture of the universe, moving and wiggling around in space-time. A cosmic string may be many light-years long, but far thinner than the width of a human hair, and may contain the mass of billions upon billions of stars. A cosmic string may also carry an extremely strong electrical current.

Can Cosmic Strings Be Used To Travel Backward In Time?

The American astrophysicist J. Richard Gott (1938–) has published a book describing a special kind of time machine that might be possible using cosmic strings. In a nutshell, if there are two straight cosmic strings passing close by to one another as they move about in the universe, the space-time between the two strings will be heavily distorted by the strings' gravitational influence, and time could loop around in a strange configuration. If an object can somehow follow that loop in exactly the right way, it could wind up taking a wild, corkscrew path through time so that it would end up in a location in space-time before where it started. Research into the theoretical possibilities of such a "Gott time machine" continues, but again, no cosmic strings have ever been detected, let alone two.

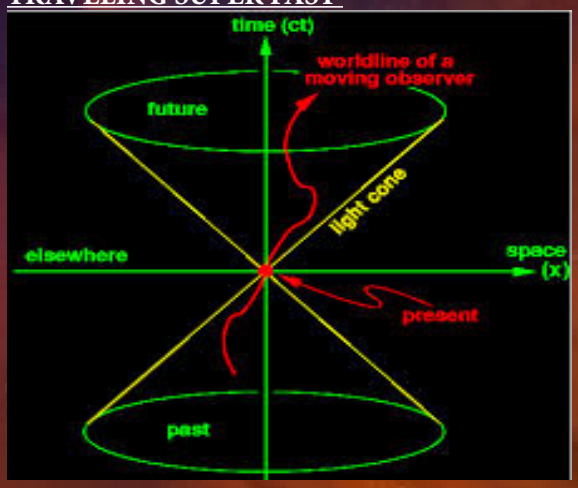
Do Cosmic Strings Really Exist?

No cosmic string has ever been detected. Every once in a while, observational evidence suggests that a cosmic string might have been seen, but these observations have never been confirmed. It may be possible that the universe may have contained many cosmic strings early in its history, but almost all of them may have decayed away by now.

BLACK HOLES

Another key to time travel are black holes, objects so dense that not even light can escape their gravitational grip. They are also called as natural time machines. "A black hole … has a dramatic effect on time, slowing it down far more than anything else in the galaxy. That makes it a natural time machine," Hawking writes. Here's how it might work: Imagine a spaceship orbiting the super-massive black hole at the center of the Milky Way galaxy, 26,000 light years away. From Earth, it would look like the ship is making one orbit every 16 minutes, Hawking writes. "But for the brave people on board, close to this massive object, time would be slowed down," Hawking writes. "For every 16-minute orbit, they'd only experience eight minutes of time." If they circled for five years, local time, 10 years would have passed back on Earth. This scenario doesn't produce the paradoxes inherent in wormhole travel, but it's still pretty impractical, Hawking acknowledges.

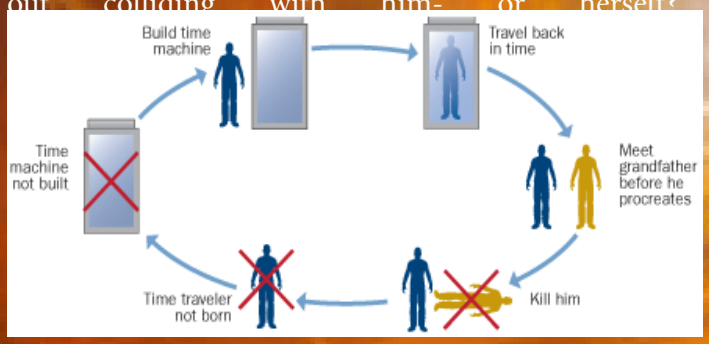
TRAVELING SUPER FAST



But there's one more possibility: traveling super fast. "This is due to another strange fact about the universe," writes Hawking — the cosmic speed limit: 186,000 miles per second, or the speed of light. "Nothing can exceed that speed. It's one of the best established principles in science," writes Hawking, but "believe it or not, traveling at near the speed of light transports you to the future. "Imagine a track that goes right around Earth, a track for a super-fast train. Onboard are passengers with a one-way ticket to the future. The train begins to accelerate, faster and faster. Soon it's circling the Earth over and over again. To approach the speed of light means circling the Earth seven times a second. But no matter how much power the train has, it can never quite reach the speed of light, since the laws of physics forbid it. "Instead, let's say it gets close," writes Hawking. "Something extraordinary happens: Time starts flowing slowly on board relative to the rest of the world, just like near the black hole, only more so. Everything on the train is in slow motion."

PARADOXES

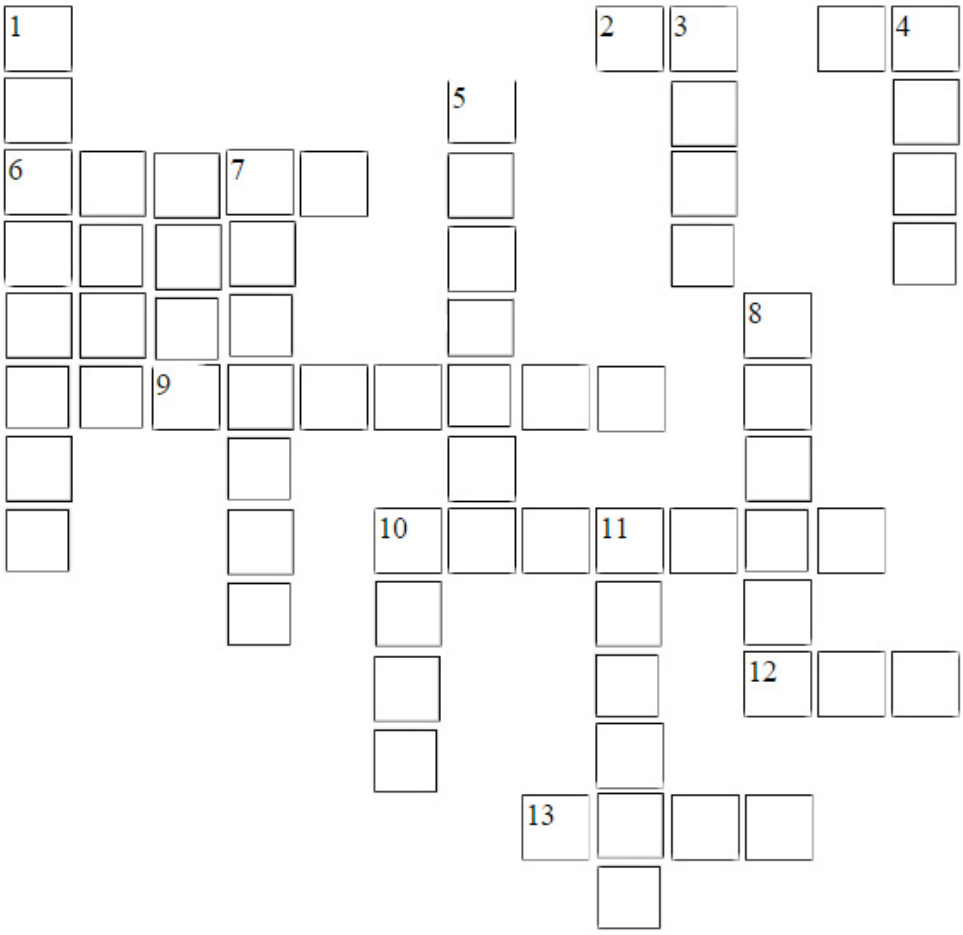
The Birmingham project will have to address some classic arguments against time travel, such as the "grandfather paradox". This argues that if someone could go back in time they could kill their own grandparent and so make it impossible for the time traveler to be born. And if they were never born they could never go back and time travel becomes an impossibility. When apparently sound reasoning leads to a contradictory conclusion, a paradox is the result. Many paradoxes arise in the consideration of time travel. Below are some of the paradoxical topics to be explored: The Grandfather Paradox: Can a person who has traveled to the past kill his or her own grandfather? The Self-Visitation Paradox: Can a person visit himself or herself? How can there be two of one person at once? The Nowhere Argument: If only the present moment exists, how could we travel to the past or the future? The Double-Occupancy Problem: Can a person time travel backwards in time without colliding with him- or herself?



So is time travel possible?

While time travel does not appear possible — at least, possible in the sense that the humans would survive it — with the physics that we use today, the field is constantly changing. Advances in quantum theories could perhaps provide some understanding of how to overcome time travel paradoxes. One possibility, although it would not necessarily lead to time travel, is solving the mystery of how certain particles can communicate instantaneously with each other faster than the speed of light. Time travel may be possible but it is beyond our current technological capabilities. In the meantime, however, interested time travelers can at least experience it vicariously through movies, television and books.

ENIGMA



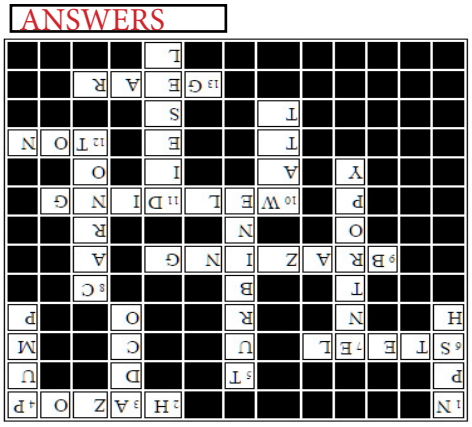
Across

2. HAZARD STUDY
6. CONSTRUCTION MATERIAL
9. JOINING METAL AT LOW TEM.
. PERATURE
10. JOINING METAL
12. RELATED TO REFRIGERATION
. CAPACITY
13. TORQUE CONVERTER

Down

1. RELATED TO PUMP SUCTION
3. ONSHORE OIL COMPANY
4. FLUID MOVER
5. ENERGY TRANSFORMER
7. INCRESING CHOAS
8. CYCLE
10. UNIT OF POWER
11. ENGINE

ANSWERS



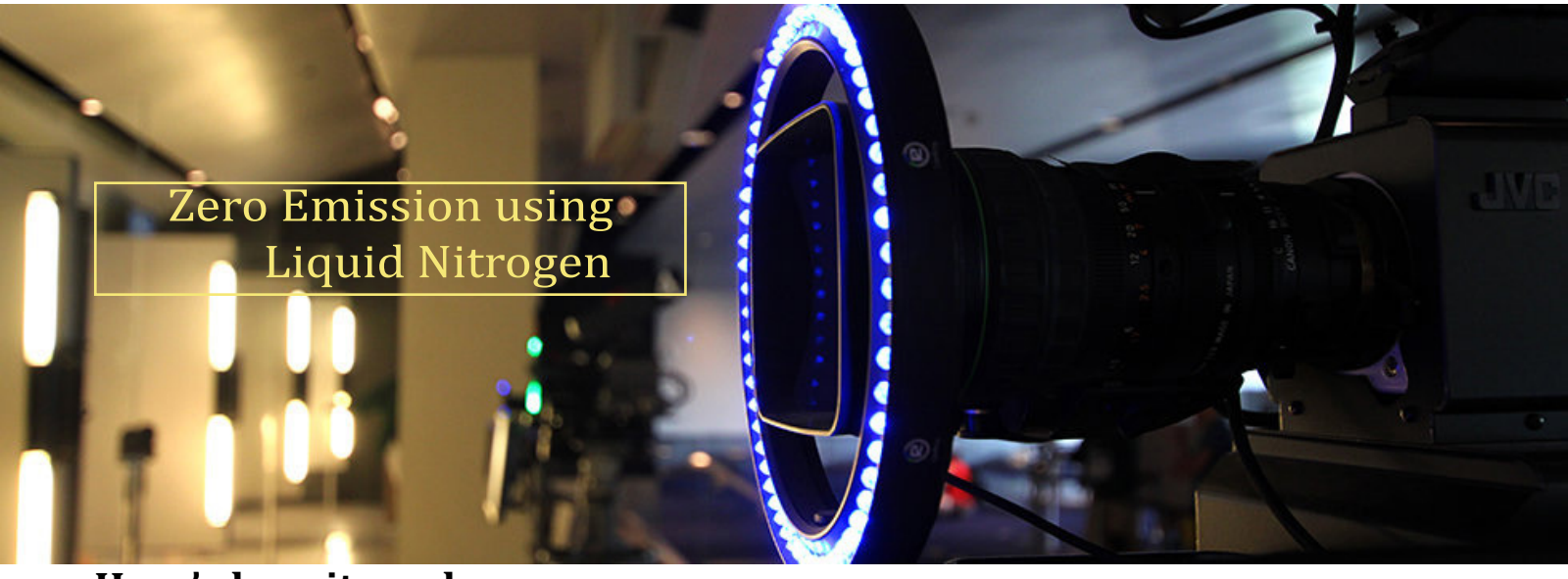
Dearman Engine

In todays world with dire consequences of global warming and pollution haunting everyones mind, the drive to develop emission free engines have been recieving more and more backing from industrial front, chief amongst the proposed alternative include hydrogen fuel cells, electric cars, compressed air and solar powered vehicles.

The Dearman Engine proposes to be an alternative which could challenge the forecasted dominance of these above mentioned motive sources.

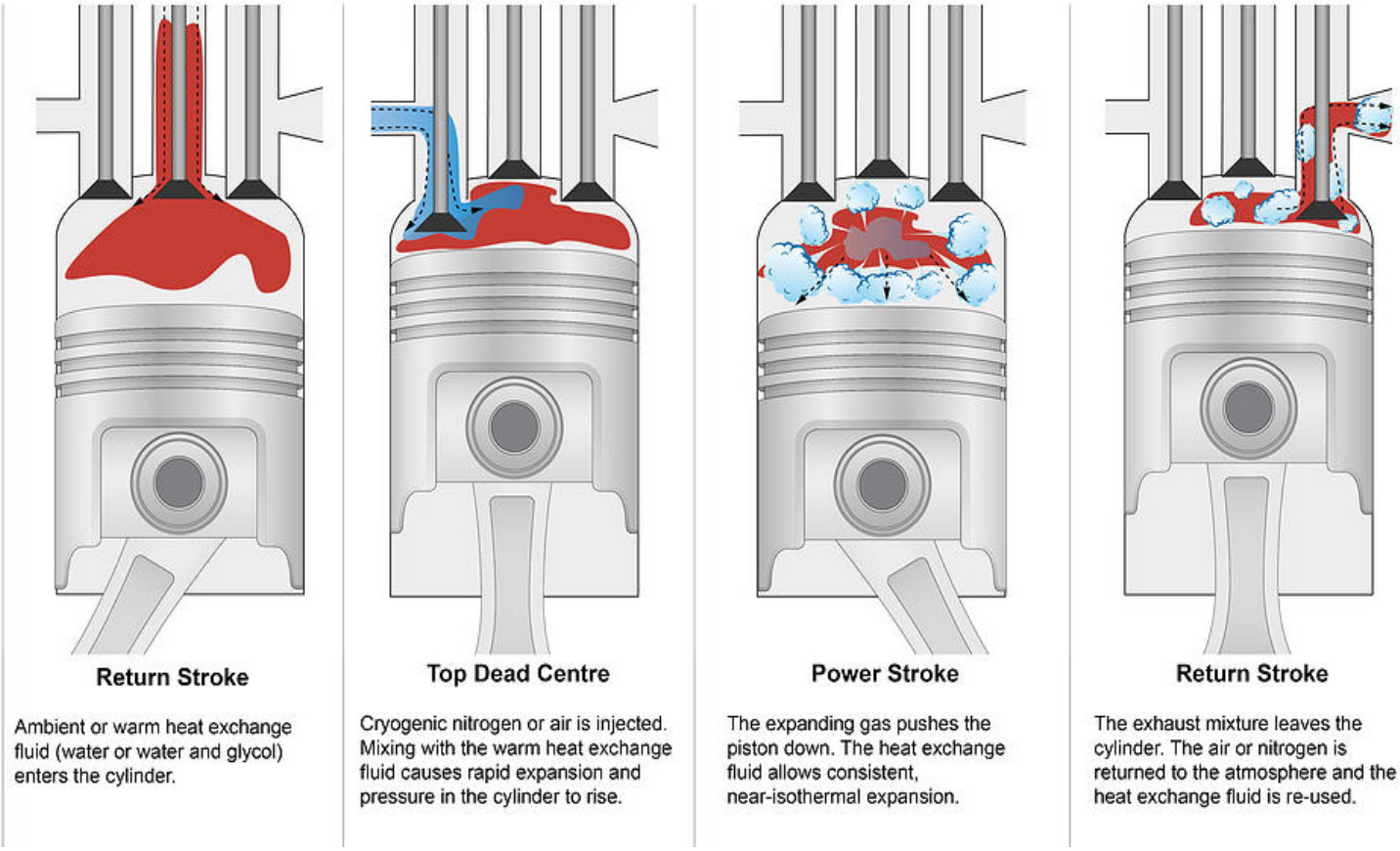
The Dearman Engine is in most ways a cryogenic engine, It was developed inthe U.K. by Peter Dearman, who later started the Dearman Engine Company to further his ideas.

Deepak Sunil Abraham
S6 ME



Here's how it works:

- ***1.*** A heat exchange fluid is pumped into the engine cylinder as the piston approaches the topmost position of its travel (TDC)
- ***2.*** Nitrogen which has been cooled to Cryogenic temperatures (below 113 K) is now introduced into the cylinder. It is in the liquid state at this time.
- ***3.*** The heat exchange fluid which is close to ambient temperature causes liquid nitrogen to expand rapidly pushing the piston down, producing useful work.
- ***4.*** The mixture is expelled as the piston moves up again the heat exchange fluid is re claimed while the nitrogen is released back in to the atmosphere and the cycle repeats



There are numerous advantages to the Dearman Engine compared to other means of motive power both conventional and non-conventional.

1. It can be made from conventional technologies: No speacial Materials are required for the making of this engine as is the case of hydrogen fuel cells and batteries

2. The engine can be used both indoors and outdoors with equal ease as it only gives out harmless liquid nitrogen as by product.

3. The Engine is lightweight compared to its I.C. Engine Counterparts and conventional electric motors.

4. It is easy to refill the liquid nitrogen supply similar to the way petrol is refueled at petrol pumps as compared to Hydrogen and Electric systems which take a long time to recharge

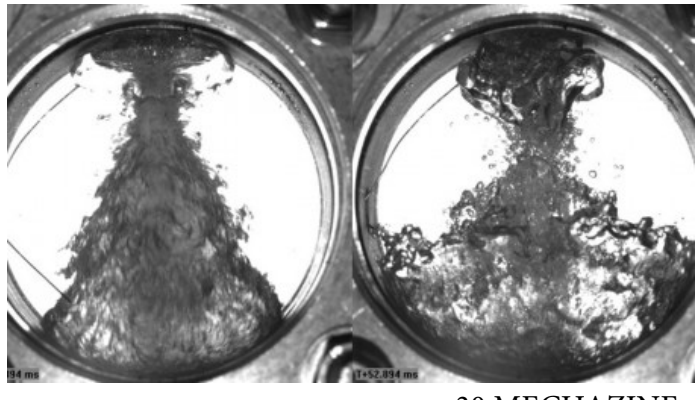
5. The storage of liquid nitrogen does not propose much of a challenge as it is fairly easy to store as opposed to hydrogen tanks or battreries in case of electric vehicle

6. Significant infrastructure already exists which can produce large quantities of liquid nitrogen to meet the demand for Dearman Engines

As can be seen from the advantages that the Dearman Engine offers the proposed technology certainly has a place in future motive power generation scenario which are becoming increasingly becoming non emission freindly owing to tighter government norms and growing environment consciencous consumers. The engine while offering lots of promises has to overcome huge hurdles if it is to reach commercial success:

1. Achieving power densities comparable to I.C. Engines
2. Setting up of liquid nitrogen refueling stations on a large scale
3. Work towards convincing the industry at large and the consumer market regarding the capabilities of liquid nitrogen based systems

Super Heating of Cryogenic fluids

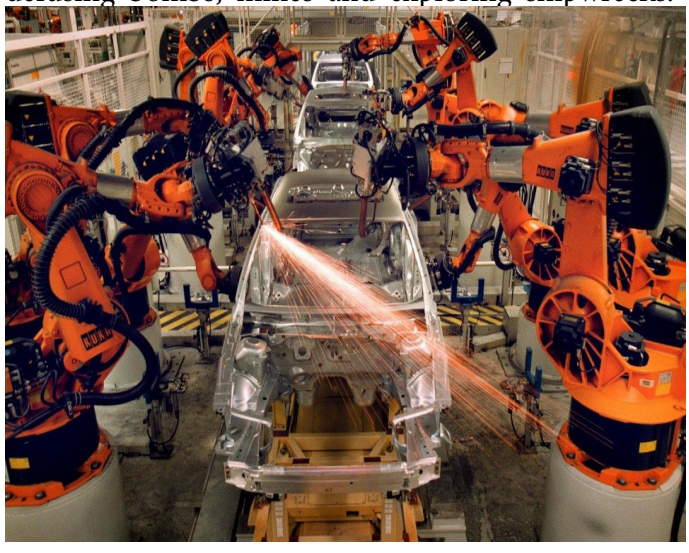


India's venture into a whole new economy

ALAN JACOB PHILIP
S6 ME

There are an endless number of things to discover about robotics. A lot of it is just too fantastic for people to believe.
Daniel H. Wilson

Robotics deals with the design, construction, operation, and application of robots coupled with computer systems for their control, sensory feedback, and information processing. Very often the design of a given robotic system brings together principles of electronic engineering, mechanical engineering and computer science (artificial intelligence in particular). Since the turn of the 20th century, research into the functionality and potential uses of robots has seen a lot of action. Given the rapid pace of technological advances, the research, design, and building of new robots have begun to serve various practical purposes – domestically, commercially and militarily. Today, many robots do jobs that are hazardous to people such as defusing bombs, mines and exploring shipwrecks.



Industrial robots form an essential part of the current manufacturing sector of India. Without the use of robotics technologies or cost-effective production, a pillar of emerging Indian wealth would not be possible. Furthermore, robot-based production increases product quality, improves work conditions and leads to an optimised use of resources. The miniaturisation of robotic technologies and newly developed sensing capabilities mean that these benefits are becoming applicable to an even wider range of manufacturing industries, including those with small and varying lot sizes, materials and product geometries.

Driven by the increased security needs of Indian citizens and the higher workload resulting from extended monitoring of our everyday environments, robots already play an increasing role in the security market. Tele-operated mobile systems are now being used in a number of security applications including bomb disposal. In the future, robots will autonomously assist with the protection of offices and homes, and will help secure borders or monitor the environment in both routine and emergency operations.

The world around us is constantly evolving in unprecedented ways, at an unimaginable speed. The robotic age, something we're used to reading about in science fi ction is fi nally becoming a reality. The result? Hopefully, a robot in every house. Robots have a long history, from fi ctional, to industrial robots and mobile robots. Industrial robots have taken a long stride and are well established, but newer domains and research has got most of the limelight. Although the vast majority of robots today are used in factories, advances in technology enable robots to automate many tasks in non-manufacturing industries such as agriculture, construction, health care and other services. India is now emerging as a destination for the production of industrial robots. In fact, the size of the Indian robotics market is large with sales fi gures hovering around Rs. 3,500 crores. Most of this (around 70 per cent), is in the automotive industry

India is an upcoming potential market for industrial robotics industry with a worldwide market share of approximately 15 per cent. With suitable stimulation and investment in the key underlying technologies, a broad range of robotics activities can be enabled. Key to this is the identification of first-wave technologies that will drive early markets

Growing demand for industrial robots has attracted leading global manufacturers of robots as Kuka Robotics, ABB, Fanuc etc. to set up facilities in India to serve the Indian market. India's transformation into an automobile hub, with several leading international auto majors in the country, becomes the primary driver for the robotics and automation industry. The

Indian manufacturing arena is poised to grow larger in the coming decades; thereby robotics industry business will remain vibrant.

The automation industry is driven currently by the automotive, power, chemicals and fertilisers, and oil and gas sectors.The other sectors that also use automation to lower variance are the pharmaceutical, food and beverages, water and wastewater, cement, textile, metals, and the mining industry. The challenges faced by India today are:

- Increase knowledge and awareness levels about the role of automation and its value proposition
- Help Indian industry leverage cutting-edge automation technologies to be globally competitive
- Enhance top management integrated automation
- Create sensitivity to benefits of automation and build synergy amongst industry, researchers, policy makers and users through seminars and symposia
- Support safety and compliance standards in manufacturing
- Attract job aspiring community to automation.

The range of what can be automated is widening rapidly. The first robotics revolution—ushered by General Motors in the 1960s with robotic arms that stacked hot die-cast metal pieces—substituted capital for labor in the most dangerous, difficult and labor-intensive tasks. Today, we're in the midst of a second robotics revolution. Thanks to the new field of "machine learning," second-generation robots no longer require step-by-step commands by a human.

Medical robotics

Medical robotics is causing a paradigm shift in therapy. The rapid growth in medical robotics is driven by a combination of technological improvements (motors, materials and control theory), advances in medical imaging (higher resolutions, magnetic resonance imaging and 3D ultrasound) and an increase in surgeon/patient acceptance of both laparoscopic procedures and robotic assistance. Intensive research on medical robotics in current scenario and future may encroach various medical domains, such as:

Medical robots must develop a firm basis in improved medical outcomes, or risk being displaced by pharmaceuticals, tissue engineering, gene therapy and rapid innovation in manual tools. Robots will see more use for medical-training purposes, bolstered by improved tissue-modelling capabilities, by the increasing objectivity in healthcare assessment, by advances in computer simulations, and as a result of increased data mining arising naturally from improved data connectivity between devices and between institutions. Improvements in medical robotics must address and solve real problems in healthcare, ultimately providing a clear improvement in quality of life when compared with the alternatives.

MINIMAL ACCESS ROBOTIC SURGERY

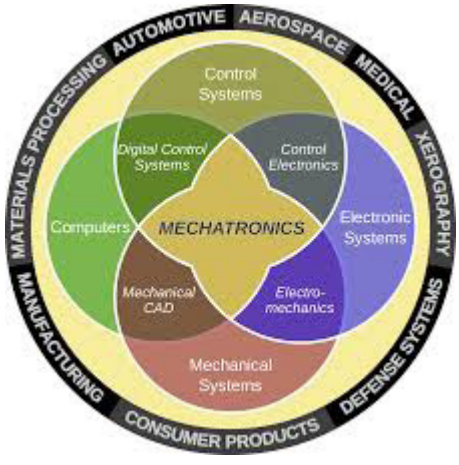
Aster Medcity, for the first time in Kerala, introduces Robotic Surgery with da Vinci Robot- a highly advanced surgical Robot that performs minimally invasive surgeries with utmost precision. What can be called the next level in surgery, the da Vinci Robot has multi-limbed surgical robot with tiny wrists that bend in all directions, offering precision, dexterity and fine manipulation beyond that of human hand. The Surgeon performs minimally invasive surgeries by manipulating three robotic arms and a video camera that are inserted through small skin incisions, while seated in front of a computer console with 3D video screen and controls. The option of Robotic surgery is available in the Urology, Cardiothoracic, Gynaecology, Oncology, Gastroenterology, Bariatric and Paediatric Surgery Departments at Aster Medcity.

Advantages of Robotic Surgery

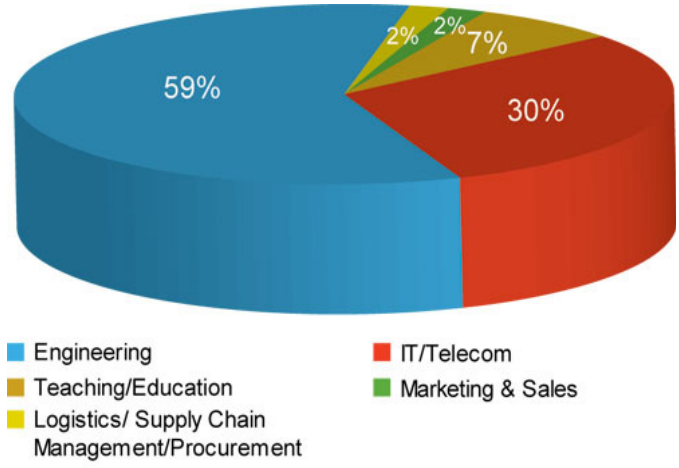
- High-precision surgery
- Minimal invasion
- Significantly lesser pain
- Lesser blood loss
- Fewer surgery related complications
- Short stay at hospital
- Quicker recovery
- Enables the patient to get back to normal life faster

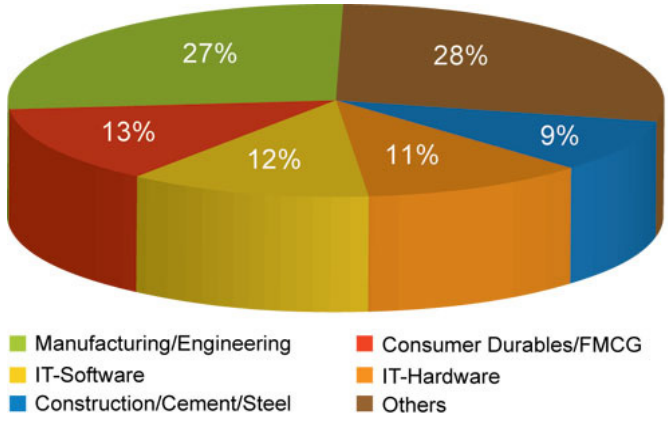
Mechatronics vs Robotics (Automatic vs Autonomous)

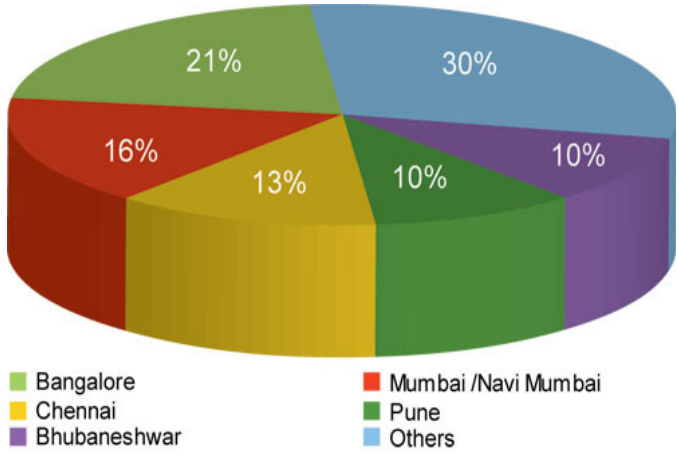
Mechatronics is a multidisplinary between mechanical, electronics and computer engineering. The word Mechatronics itself came from "mecha" for Mechanical and "tronics" for electronics. Robotics can be considered as part of Mechatronics as it involves these mechanical, electronics and computer engineering fields. The main difference is inputs are "provided" to mechatronics systems whereas robotics systems "acquire" inputs by their own.



"There is a lot of scope in the mechatronics sector," believes Dr S.K. Saha, Naren Gupta chair professor, Department of Mechanical Engineering, IIT Delhi. He says, "Today almost everything we use in our daily life, like mobile phone (it has a motor for vibration and of course other electronic items inside to show the display, communicate with other users, etc), washing machine, motor car, etc, is a combination of mechanical and electrical/electronic items. Hence, the knowledge in that area is a must in case somebody wants to work in companies To design and develop products in the mechatronics domain in India, 27 per cent engineers are hired by the engineering/manufacturing sector as per TimesJobs' statistics. Thirteen per cent work in the consumer durable/FMCG sector, 12 per cent in the software industry, 11 per cent in the hardware industry and 9 per cent in construction/cement/steel industry. Remaining 28 per cent are scattered amongst the other industries.







Designing, building and operating intelligent products, mechatronics engineers will be increasingly in demand as more and more industries look to employ evolutionary advances made in the field of mechanical, electronics, computers and sensors to improve systems.

Cochin International airport limited has introduced a high-end robotic safety system (Canadian-built) with the induction of a Remote mobile investigator and two threat containment vessels by spending Rs. 12 crore.

"….It represents the leading edge of airport safety . We always support the advancement of technology especially in safety issues "CIAL managing director Mr.V.J.Kurian IAS .

The family of safety robots developed by Pedsco (Canada) Ltd , Threat containment vessel and sophisticated luggage containment vehicle (both developed by Nabco, USA) were handed over to CISF. Remote mobile Investigator (RMI)-9WT is the front runner in the robot family. It is used in the West and Americas by Police, fire departments, Military and Nuclear and industrial institutions. It is a light weight, battery operated multi purpose vehicle that has proven to be ideal for the remote handling of Improvised Explosive Devices, Hazardous Chemicals, Radio active materials, Fire fighting, Hostage situations, Hijackings and other Hazardous situations. The RMI series robots have been chosen by experienced technicians world wide due to its' dependability, simplicity and ease of operation. It traces the explosives with eight inbuilt cameras and X-ray unit. Power drillers, claw tools, gun camera with integrated aiming lasers are other paraphernalia attached to the robot Apart from robots, a threat containment vessel (TCV) which is capable of handling the suspected luggage identified by the robots and is capable of containing heavy blasts. This container is reusable in the sense that it withstands repeated detonations. If the suspected luggage is below the KG limits; the small version of TCV (Suspected luggage containment vessel)would be deployed.

Apart from these Bomb inhibitor (used to protect people and structures against blast, thermal and fragmentation effects resulting from a detonation of explosives, Real Time X-Ray Viewing System (used to take real time x-ray images of the suspicious item, Deep Search Metal Detector, Non-Linear Junction Detector(intended for searching devices containing semi conductors) were also being inducted to the BDD system. The scrutiny and Implementation of high- end safety system was done by an expert committee headed by Mr. P.Gourishankar, Secutiry advisor to CIAL.

Nanorobotics is the emerging technology field creating machines or robots whose components are at or close to the scale of a nanometer. More specifically, nanorobotics refers to the nanotechnology engineering discipline of designing and building nanorobots, with devices ranging in size from 0.1μm to 10μm and constructed of nanoscale or molecular components. The names nanobots, nanoids, nanites, nanomachines or nanomites have also been used to describe these devices currently under research and development.

TABLE I
Application Scenarios

Sectors / Application scenarios	Industrial	Professional service	Domestic service	Security	Space
Robotic workers	Large structure manufacturing (incl. civil engineering)	Human-like assembly robot			Orbital robot agent
	Robot with integrated process control	Professional cleaning robot			Planetary robot agent
	Rapidly adaptable manufacturing cell	Maintenance robot			
	Postproduction automation (recycling, remanufacturing)	Coordinated mobile manipulators			
	Forestry and agriculture robot Robot automation for small-scale manufacturing Mining robot Micromanufacturing robot				
Robotic co-workers	Robotic assistance in industrial environments	Robotic assistance for professionals Surgical robot	Personal robot Robotic assistance for physically challenged	Robotic assistance in security contexts	Orbital robot assistant Planetary robot assistant
Logistics Robot	Autonomous transport of goods Autonomous transport of people				
Robots for surveillance and intervention		Site protection (domestic and professional)		Border surveillance Security checks of goods and people	
Robots for exploration and inspection	Disaster management Rehabilitation robot	Underwater robot		Inspection In environments inaccessible to humans	Orbital robot explorer Planetary robot explorer
Education and entertaintment robots		Motion simulator Robot guide Robot teacher Robot trainer	Robot companion Robot toy		

Pay Package

Shifting focus towards the financial aspect of the job, small and medium companies typically offer a stipend of up to ₹ 10,000 per month till the end of training period. On confirmation, the companies offer anywhere between ₹ 16,000 and ₹ 20,000 per month. Some of them also provide free transport and canteen facilities. Bigger companies usually keep freshers under probation for three to six months, offering a package of anywhere between ₹ 300,000 and ₹ 500,000 per annum.

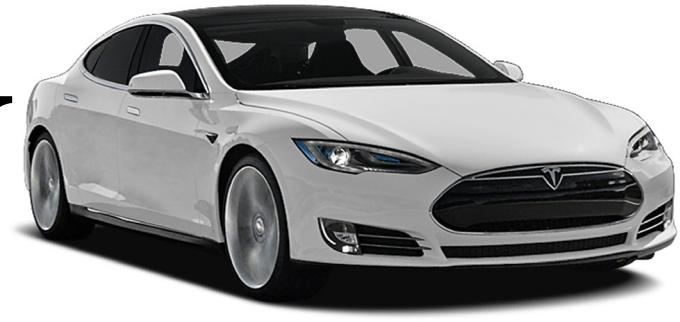
Sudhir Reddy says, "We recruit mechatronics engineers and offer industry-standard packages for freshers which range from ₹ 300,000 to ₹ 400,000 to start with. However, we don't restrict ourselves on salary if we get the right candidate. We know finding right talent is crucial for the organisation. All our associates ranging from top management to junior levels are assets for our organisation. Also, while recruiting we don't just look for engineering knowledge but also take into consideration the soft skills that the individual has."

According to TimesJobs.com, fifty per cent of the jobs available in the mechatronics domain are for fresher engineers with a pay package of up to ₹ 500,000 per annum. Twenty six per cent of the jobs are for juniors in this domain, offering a pay package between ₹ 500,000 and ₹ 1,000,000. Seventeen per cent of the jobs belong to mid-level experienced professionals who are offered anywhere between ₹ 1,000,000 and ₹ 1,500,000 per annum, and remaining 7 per cent evidently constitute the senior industry experts who get anything over ₹ 1,500,000 per annum. The pay packages for freshers vary from company to company.

Nanomachines are largely in the R&D phase, but some primitive molecular machines and nanomotors have been tested. The first useful applications of nanomachines might be in medical technology which could be used to identify and destroy cancer cells. Another potential application is the detection of toxic chemicals and the measurement of their concentrations in the environment.

Given that Robotics is fast entering into the industrial space in India, it is but natural that a lot of employment and entrepreneurship opportunities are opening up for people who wish to enter this growing and exciting field. From what the many entrepreneurs had to say, there is no denying the fact that there are many challenges that need to be overcome before India is seen as a go-to destination for Robotics. One of the biggest challenges that they face today is the procurement of the hardware and other electronic components that are required to build a robot. However, this can be seen as a golden opportunity for budding entrepreneurs to set up businesses that can supply "Made In India" components and hardware to the existing and upcoming companies involved in Robotics. The future of Robotics in India seems certainly bright and promising!

TESLA MODEL S: REVIEW



Reviewed By Wayne Cunningham

An unearthly amount of grip held the car through the twisty strip of asphalt running along the side of a forested mountain, and when I got on the accelerator for the turn exits, I was rewarded with instantaneous power, as much as the car and my own instincts could handle. If this were a typical car, I might have gotten good response on the throttle if I had the proper gear, but the power delivery would fluctuate as the engine speed changed.

But this wasn't any typical car: it was the 2014 Tesla Model S in Performance Plus trim. Pushing the accelerator at any speed led to instant twist at the wheels, all the energy that could be released from the 85-kilowatt-hour lithium ion battery pack to the 310-kilowatt motor, turned to kinetic force at the rear wheels. Gasoline-engine cars, with their complicated dance of fuel-air mixing and ignition to push pistons and turn a crankshaft, can't achieve the kind of direct power response afforded by the Model S' drivetrain. And it all comes down to simplicity. With fewer processes between stored power and putting rubber to the road, the electric drivetrain is naturally more efficient than the internal-combustion engine, about 90 percent versus 35 percent.

Beyond the merely theoretical, you can actually feel that superior power conversion at the accelerator. The fact that the Model S needs only a single ratio reduction gearbox, as opposed to a transmission with multiple gears, demonstrates the more direct conversion of energy afforded by the electric drivetrain.

Vive la différence!

The difference between electric and internal combustion engine wasn't lost on Tesla's engineers. They used the drivetrain's unique characteristics to rethink the whole concept of the automobile for the Model S, significantly changing how you interact with the car. As one example, there is no key for the Model S. Neither is there a start button or a parking brake. All these things are legacies from the last century of motoring, made unnecessary by today's technology. Walk up to the car with its Model S-shaped fob in your pocket, and it unlocks, the door handles automatically extending. Getting into the Model S makes the instrument panel and the massive, 17-inch centre touchscreen light up. Set the steering column-mounted drive selector to D, push the accelerator, and you're off. Similarly, putting the car in Park and getting out effectively turns it off. Walk away or push a button on the fob, and the doors lock. It takes a little getting used to, but the Tesla Model demonstrates 21st century driving. While pushing the accelerator gives direct access to the stored power, lifting off makes the car slow as if you were pushing the brake pedal. That's regenerative braking taking hold in a style other automakers now call one-pedal driving. On freeways, I never actually had to touch the Model S' brake pedal, as lifting off the accelerator slowed it enough to cope with slower traffic ahead. On city streets, I didn't have to touch the brake pedal until the Model S was down to about 3 mph, if I judged the distance to stopped traffic ahead well. As I drove the Model S over a variety of roads and at differing speeds, it occurred to me that Tesla engineers also did a remarkable job of tuning the accelerator modula

tion. Backing into a parking space, just a little pressure on the pedal gave me excellent control during low-speed maneuvering, the drive systems letting only a bare trickle of the electrons flow to the motor. Holding suburban speeds, 35 to 45 mph, proved easy enough, but my favorite part of the throttle cycle involved tipping it in beyond 75 percent. Like a rocket on electric rails, the Model S bolted forward, the juice flowing to a point where I could feel the tremendous momentum taking over, a visceral example of Newton's first law of motion. And if I had the guts -- or enough open road ahead of me -- holding that throttle position kept up the acceleration. Tesla notes that the Model S, in Performance Plus trim, hits 60 mph in 4.2 seconds, a time even more impressive when you consider the car's 4,647-pound (2,108kg) curb weight. Those people not ready for this new driving paradigm can make the Model S perform a little more like a traditional car. Pull up the drive settings on the center LCD, then switch Regenerative Braking to Low and turn Creep to On. These settings let the Model S coast more easily and make it crawl forward as soon as you lift off the brake, just like a gasoline engine car with an automatic transmission. Considering other more traditional automotive attributes, the Model S rides as it looks: solid and elegant. Air-cushioned dampers help soak up the road, but that doesn't mean a soft ride. There is no excessive bounce in the suspension, just the dampers and springs maintaining the car's composure. To enhance aerodynamics, the Model S automatically lowers at freeway speeds, and you can set the suspension to a high position when negotiating speed bumps or other obstructions. The drive settings let me choose from Sport, Standard, or Comfort for the electric power-steering program, going from a good amount of heft to easy, one-handed turning. In each setting, the response was precise but also a little numb, the sort of point-and-shoot feeling that often comes from electric power-steering programs.

Double-plus good

The Performance Plus package includes heavy duty dampers and sway bars, which I enjoyed as much as possible on twisty back roads. The Model S feels heavy from behind the wheel, and I expected that to make for clumsy handling when really pushed. Instead, the car held its own extremely well, its 48/52-percent weight balance between front and rear wheels taming understeer while the big, Michelin PS2s on 21-inch wheels gripped the asphalt. The Model S could not so defy physics as to rule out load shift in the turns, and it wasn't light enough that I would call it nimble, but I couldn't get it to break grip. The Performance Plus trim adds more to the Model S than suspensions upgrades, not the least of which is price. The example I drove, fully loaded out, came in at above $120,000 almost twice that of the base Model S with a 60-kilowatt-hour battery pack. Tesla upgrades the electric motor in Performance Plus to 310 kilowatts, producing 443 pound-feet of torque, from the base model's 225-kilowatt motor and the 270-kilowatt motor in the middle-ground 85 kilowatt-hour Model S. The US Environmental Protection Agency (EPA) puts the range for both the Performance Plus trim and standard 85-kilowatt-hour battery pack at 265 miles, and 208 miles with the 60 kilowatt-hour battery pack. The EPA gives an mpg equivalent figure of 89 for the Model S, which serves to show how efficient the car is compared to gasoline-engine cars, but little else. Another number that might prove more useful is the EPA energy usage of 38 kilowatt-hours per 100 miles. The Model S' trip computer showed I handily beat that

rate, even with a fair amount of fast starts and mountain driving, turning in 33 kilowatt-hours per 100 miles over a few days' driving.

In comparison to other electric cars and current technology, 85 kilowatt-hours is a massive amount of juice. Plugging into a 110-volt outlet using one of the Model S' adapter cables only added 4 miles of range per hour. At a 240-volt charging station, Tesla says the car will gain 29 miles of range per hour, what most owners will get in their own garages. An associated mobile app lets you view charging progress and schedule charging remotely. The more recent innovation from Tesla for charging the Model S are the Supercharger stations the company is setting up around the world. I took the Model S out to Vacaville, Calif., to give this fast-charging solution a try. With eight chargers set up in an outlet mall parking lot, I had no trouble finding an open space. Plugging into the Model S' unique two-prong port, the car showed a charging source of 355 volts and 111 amps, enough to add 100 miles of range to the car in about 15 minutes. Model S owners get the additional perk of completely free charging at these Supercharger stations.

Hero of the cabin

The Model S showed me the trip-computer information, vehicle speed, and, most importantly, the remaining range via its LCD instrument panel, with a virtual gauge completely in keeping with the car's high-tech nature. The virtual gauge showed me speed in analog form and included a measurement of energy usage or regeneration, this latter information useful as a coach to maximize efficient driving.

This instrument panel screen is well designed and let me see the car's infotainment functions on its right side. But the Model S' main party piece, what designer Franz von Holzhausen calls "the hero of the cabin," is the 17-inch touchscreen LCD panel dominating the center dashboard. This screen is certainly the largest currently used in autodom, and it serves to mark another break from the traditional car paradigm. This big screen, coupled with the Model S' built-in data connection, works like a tablet controller for infotainment.

Rather than the rows of buttons and complicated indirect controllers for small LCDs showing navigation and audio features in other cars, Tesla chose a minimalist design, reasoning that almost every feature accessed by hard buttons in other cars could be controlled on the LCD. BMW tried something similar with the first version of iDrive years ago but ended up hiding too many commonly used controls. Tesla made its interface much more usable, for example putting climate controls along the bottom of the screen in a persistent strip. Likewise, the stereo volume control also appears on that strip.

Another persistent strip at the top of the screen shows icons for navigation, the stereo, energy usage, and the Web browser, among other features. The main area of the screen can show a big Google map delivered to the car through its data connection, the stereo interface, Web browser, or other screens. Or at the driver's choice, it can show stacked screens. I commonly chose to have the map at the top and stereo at the bottom.

If you have ever used a Linux desktop, the windows and panels showing on the Model S' main screen will have a familiar feel. The touch areas deliver solid and quick responses, and easily let you swap top and bottom screens or choose one to fill the entire area. Other screens, such as the drive settings, appear as panels on top of the main screens.

Navigation works similar to Google Maps, with a simple search box at the top of the map screen. Tesla supplements that, however, with a panel showing nearby Superchargers, recently used charging stations, and recent destinations. The car I drove came with the optional stored map navigation system, useful for driving in areas outside of data coverage. It showed maps on the left side of the instrument panel, with identical turn-by-turn directions on that and the main LCD. The only time the maps went out of sync was when I crossed the new span of the Oakland-San Francisco Bay Bridge, which had not been updated on the stored maps.

Room for improvement

Another area where Tesla differs from other car companies is its over-the-air updates to the Model S' software, upgrading systems and adding features so that the concept of a model year becomes meaningless. Except for the fact that there is only so much that can be done with software -- at some point the Model S will need new hardware.

In comparison to other premium cars on the market, the Model S is severely deficient in driver-assistance technologies. A rear-view camera and sonar distance sensors are all that can be had currently. More systems, such as adaptive cruise control and pre-collision braking, will require new hardware. Tesla is purportedly working on what it calls autopilot features, but it seems unlikely to retrofit existing cars.

LED headlights are quickly being adopted by the automotive industry, coming standard on vehicles such as the Acura RLX, but not yet to be seen on the Model S. LED headlights would take some of the drain off the battery pack during night driving, shine brighter than the current lamps, and last longer. I mentioned the lack of new audio apps for the Model S above. It seems that Tesla could add a number of apps to the car, such as weather or social media, with its over-the-air updates. The car's built-in Web browser, however, which can be used while underway, can currently load sites with those tools. Third-party developers have come up with some useful features for the Model S' Web browser, such as QuickTesla, which includes weather and a news feed. In the past, Tesla has said it will support third-party apps running on the Model S' infotainment system. Some reports suggest this capability will come later this year.

A base level Model S, with 60-kilowatt-hour battery pack, goes for $71,070 in the US, and qualifies for a $7,500 federal tax incentive. In the UK, that model will cost £50,280 and avoid the Congestion Charge in London. Australia residents will pay $97,245 for the base Model S.

In Performance trim with the 85-kilowatt-hour battery pack, the Model S will run $94,570 in the US, £69,080 in the UK, and $134,294 in Australia. The Performance Plus package and a host of other options, such as the premium audio system and Tech package in the car I drove, take the total cost substantially higher.

Tech specs

Model	**2014 Tesla Model S**
Trim	**P85 Plus**
Powertrain	**85-kilowatt-hour lithium ion battery pack, 310 kilowatt electric motor**
EPA fuel economy	**38 kilowatt-hours/100 miles**
Observed fuel economy	**33 kilowatt-hours/100 miles**
Navigation	**Standard, with live traffic**
Bluetooth phone support	**Standard**
Digital audio sources	**interrnet-based streaming, Bluetooth streaming, USB drive, satellite radio, HD radio**
Audio system	**12-speaker system**
Driver aids	**Rear-view camera**
Base price	**$69,900**
Price as tested	**$123,620**

A PEEP INTO THE PETROLEUM INDUSTRY

Sivanandan K
Vice President (Technical)
at Petronet CCK Limited

Petronet CCK Limited is a joint venture public limited company promoted by M/s. Bharat Petroleum Corporation Limited, M/s. Petronet India Limited and financial institutions. Petronet CCK Limited has laid a petroleum product pipeline from Bharat Petroleum Corporation Ltd's Cochin dispatch terminal (Irimpanam) to Karur via Coimbatore for transportation of petroleum products.Here, we have Mr. Sivanandan K , Vice President (Technical) at Petronet CCK Limited with us to give a deep insight into Petronet CCK.

What are the major challenges faced by PETRONET CCK with regards to laying of pipeline?

There were few major challenges we faced while laying the pipeline in the period of 2000-2002. The population density is high in Kerala compared to other states in India. Getting an ideal pipeline route avoiding residential areas fully was not possible. However, we could lay the pipeline as per the national/international standards without removing any structures in Kerala. Another challenge was legal litigations against the project faced from the land owners. Oil & Gas pipelines are in layed in the country under The Petroleum and Minerals Pipelines (Acquisition of Right of User in Land) Act, 1962. Even the constitutional validity of the Act was questioned by the land owners in Kerala High Court. We could clear all those legal and other resistance form the land owners and layed the pipeline peacefully.

Whatkindofpumpsdoyouusetomovesuchhigh viscous liquids through such large distances?

High pressure multistage centrifugal pumps are used for pumping petroleum products.

"Sectionalizing Valves" find mention in your website, can you explain what these are & what purpose they serve?

Sectionalizing valves (normally one valve for every 50km) are provided in the cross country pipelines to isolate the pipeline in the event of any unfortunate leak so that the spillage of oil is minimised reducing harm to the soil and environment.

What are some of the possible areas of innovation that you would like to see in this industry?

i. The corrosion (mainly internal) in the pipelines is a concern. Corrosion inhibitor chemicals are used for minimising the internal corrosion. There is scope for developing better chemical to counter internal corrosion fully.

ii. Another area is developing easier pipe repair methods. Clock spring, USA has developed pipe repair method without any welding/hot work.

iii. Damage to pipeline by third party agencies like earth miners/utility contractors etc is another concern. It is essential to get instant information to pipeline company in case of any unauthorised excavation happening near to pipeline. This will save damage to pipeline.

How does the company deal with oil leak & corrosion in its underground pipe system?

i. Pipeline is provided Impressed Cathodic Protection System to protect the pipeline from external corrosion. The entire pipeline is kept as

Cathode with minimum (-) 0.85 volts and sacrificial Anodes are provided so that pipeline doesn't corrode. This supplement the 3-layer polyethylene coating provided to the pipes. The internal corrosion is minimised by injecting corrosion inhibitor chemical along with the petroleum products while pumping. The pipeline is also periodically cleaned using a PIG tool.

ii. The pipeline leak is not expected as adequate care is taken with above corrosion prevention measures. In addition various pipeline surveys like CIPS/CAT, Intelligent Pigging are carried out periodically to ascertain the health of pipeline. These surveys identify and locate the weak area precisely so that Company can take action to rectify the defects before pipeline leaks

In your opinion, Is the petroleum and its allied industries becoming stagnant or Is the industry gearing up for a giant leap?

The petroleum is a fossil fuel and any abnormal increase in consumption is discouraged due to two reasons; the resource is scarce crude oil may last another 20 years and gas another 60 years. Another reason is its impact on the environment and global warming. Therefore, for India when a GDP of 7-9 % is aimed for next 15 years, the consumption of petroleum products likely to grow by a rate of 4-6%. India is surplus in crude oil refining capacity, but we imports more than 80% of our crude oil requirement. Indian Refineries produced 222.392 Million Metric Tonnes (MMT) of petroleum products in the year 2013-14 whereas our consumption was 158.407 MMT in the same year. Therefore, we can expect a moderate growth in the petroleum and allied industries. Our focus should be for higher growth in renewable energy.

Is the technical expertise required in your field of work being imported or Is the domestic technical knowledge enough to erect and maintain a growing piping network?

We have adequate technical expertise for design, construction, operation and maintenance of our pipeline networks

How does petroleum pumping compare to other modes of transportation like rail, roads?

Pipelines mode of transport for petroleum products in India is 25.8% compared to Railways- 24.5%, Road-21.4% and Coastal- 28.3%. Compared to rail & road, pipeline mode provides low energy cost, low operating cost and least pollution. The reliability of pipeline is very high, handling loss and safety hazard are negligible.

What are the common misconceptions associated with underground pipelines?

It could be safety and unwarranted worries among the public living near the pipeline

What are the future plans for PETRONET CCK and will it create more jobs for any professionals?

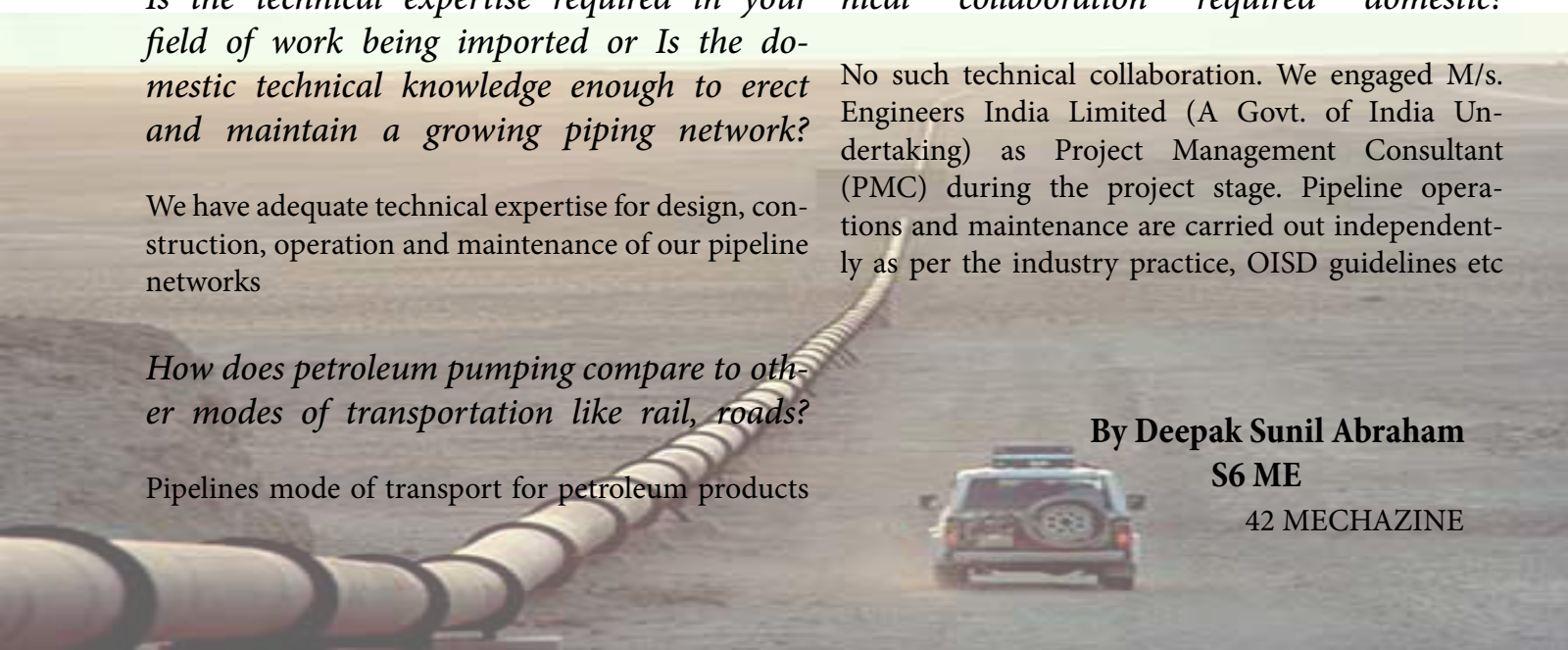
Petronet CCK Limited is a joint venture company promoted by BPCL. The Company is operating 292.5 km Cochin-Coimbatore-Karur product pipeline evacuating petroleum products of Kochi Refinery of BPCL from Irimpanam (Kochi) to Coimbatore and Karur Terminals of BPCL (market centres) since the year 2002. The Company is likely to increase the pipeline capacity on need based while Kochi Refinery undergoes Capacity expansion and may generate jobs for professionals

Comparing Indian Oil piping systems with foreign ones how would you rate the Indian system; good, better or worse? Explain?

Indian oil & gas pipelines are designed, constructed, operated and maintained as per International API/ASME standards. When we rate with foreign ones, I don't find any difference, it is good

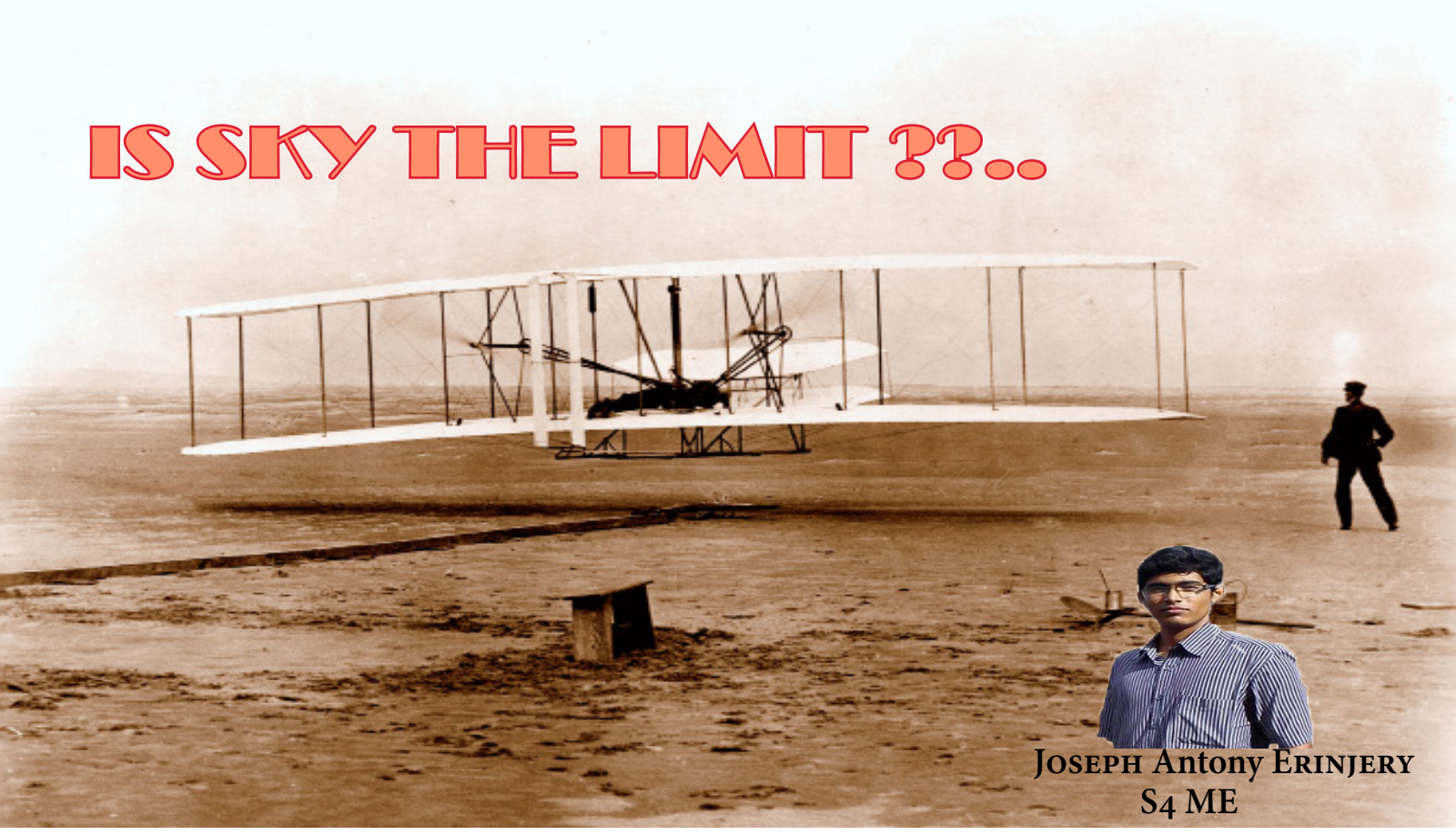
Is PETRONET CCK a part of any technical collaboration required domestic?

No such technical collaboration. We engaged M/s. Engineers India Limited (A Govt. of India Undertaking) as Project Management Consultant (PMC) during the project stage. Pipeline operations and maintenance are carried out independently as per the industry practice, OISD guidelines etc



By Deepak Sunil Abraham
S6 ME

IS SKY THE LIMIT ??..



Joseph Antony Erinjery
S4 ME

The conditions on the morning of December 17 were perfect for flight - high, consistent winds blowing from the north. At about 10:30 that morning, Orville Wright lay down on the plane's wing surface and brought its engine to life in preparation of launching it and himself into history.

Twelve seconds and one hundred and twenty feet. That is all that the first manned flight lasted. Yet through this simple act of motorised flight, the wright brothers who themselves had no professional degrees to their name breathed life into a nascent field of engineering-Aerospace engineering.

Within half a century of the first flight, we developed aircrafts that could deliver even nuclear warheads with astonishing precision. The World War (though infamous for the countless lives that fell at the battlefield) was the cradle for aerospace engineering and it was during this period that some of the meanest machines to ever roam the sky were built. These are the mechanical angels, the gladiators of the sky, the super heroes that mechanical and aerospace engineers gave birth to.

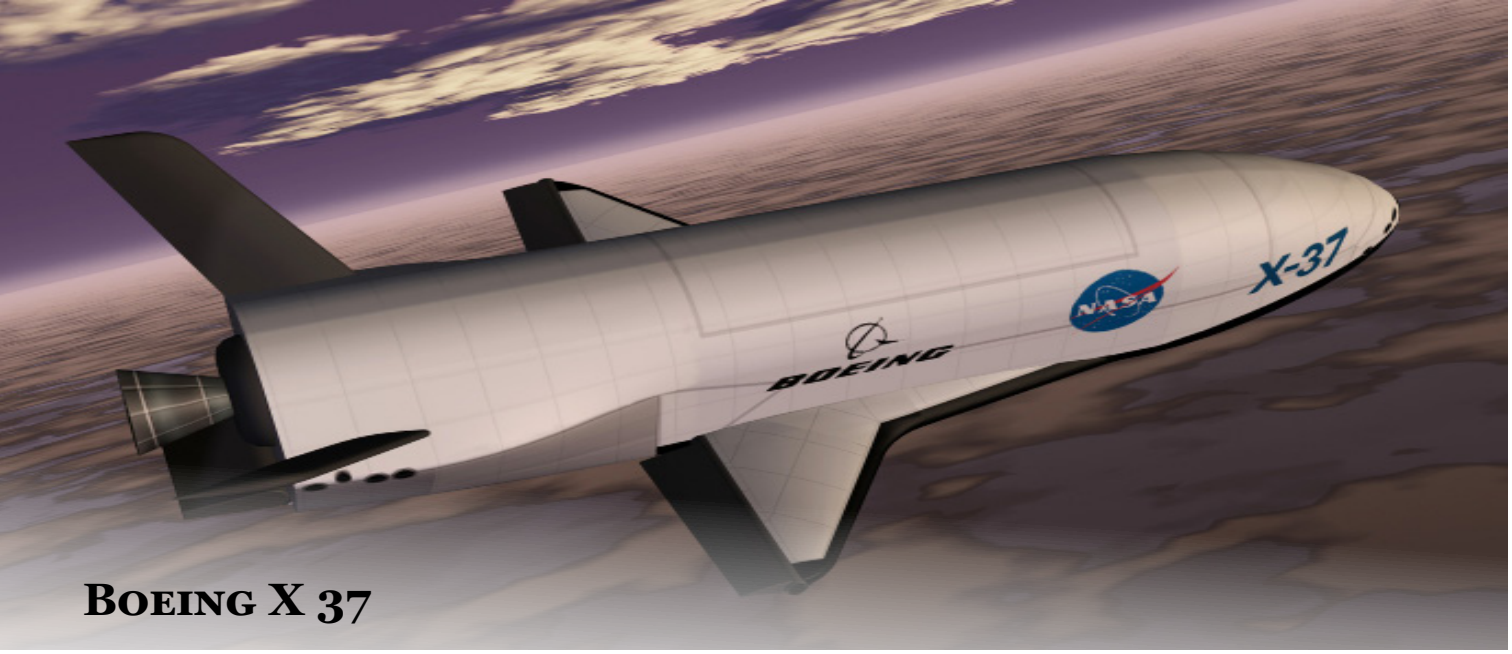
From propeller based planes to jet powered planes, from choppers to unmanned aerial vehicles (UAVs), the flying machines have constantly pushed engineering to awesome new heights. Here is a look at the some of the man made legends that roared through the skies

> *"I found the control of the front rudder quite difficult"*
> *-Orville*

Remember the sleek jet which rises out from the basketball court in the 'X Men' movie ?

As improbable as it may sound, that jet is not so farfetched from reality. It is based on the legendary **Lockheed SR 71 blackbird.**

This is the mother of all reconnaissance aircrafts. The Blackbird though long retired from the United States Air Force, still holds the record for the fastest manned aircraft ever to be built. Primarily used for reconnaissance and spying, the blackbird was simply too fast and flew at such high altitudes that no enemy weapon could bring down a single one of these tremendous machines down.



Boeing X 37

Imagine having eyes in skies .A safe haven from where you can look down on all of earth, even beyond the reach of satellites. This is exactly what the X 37 is rumoured to be.The Boeing X-37, also known as the Orbital Test Vehicle (OTV), is an American reusable unmanned spacecraft. It is boosted into space by a rocket, then re-enters Earth's atmosphere and lands as a spacecraft. The X-37 is operated by the United States Air Force for orbital spaceflight missions intended to demonstrate reusable space technologies.

The Spirit Bomber

Though it is equally devastating, the Northrop Grumman B-2 spirit is the most expensive stealth bomber on the planet.The B-2 is strategic bomber, featuring low observable stealth technology designed for penetrating dense anti-aircraft defences; it is able to deploy both conventional and thermonuclear weapons. The B-2 is the only known aircraft that can carry large air-to-surface standoff weapons in a stealth configuration.

The B2 spirit despite its jaw dropping features was way too uneconomical. The entire project cost the US government $44.75 bn and they could manufacture (due to budgetary constraints) only 21 units making the cost of each of these bombers a staggering $2.13 bn!!! Just to put that into perspective, consider this-If one made a real life replica of this aircraft in gold (such that the mass of gold used would be equal to the mass of the real aircraft), the replica would still cost less than the actual thing.

Blackhawk (Stealth Variant)

At 1 AM on the 2nd may 2011, two helicopters carrying two dozen U.S Navy seals landed near a private compound in Abottabad, Pakistan and terminated terrorist master mind Osama Bin Laden. But what made headlines to aviation enthusiasts around the world were the remains of a heavily modified top secret Blackhawk chopper that had crashed within the compound. If not for the crash, the existence of this chopper would have remained unknown to the world. This modified version of the Sikorsky manufactured Blackhawk had specific features which made it virtually impossible to track on radar. Its design included sharp edges on the body which deflected electromagnetic radiation and the entire chopper had a coating of a special radar signal absorbing polymer. This was like a ninja moving in out of sight of the enemy. In aviation terms this was a stealth chopper. The stealth Blackhawk (top) Vs the standard Blackhawk UH 60(bottom)

What next? This is one question that we as engineering aspirants always look forward to but rarely strive to answer. Though our technical knowledge in aircraft design is almost next to zero, it has to be understood that it is the idea that counts. Irrespective of how improbable some of our ideas may sound, there is no harm in exploring the unexplored and thinking the unthinkable, for history has repeatedly shown

Large Hadron Collider

The Large Hadron Collider (LHC) is the world's largest and most powerful particle collider & particle accelerator and the largest single machine in the world, built by the European Organization for Nuclear Research (CERN).The construction of the Large Hadron Collider (LHC) has been a massive endeavour spanning almost 30 years from conception to commissioning. Building the machine with the highest possible energy (7 TeV) in the existing LEP(Large Electron–Positron collider) tunnel of 27 km circumference and with a tunnel diameter of only 3.8 m ,as deep as 175 metres (574 ft) beneath the Franco-Swiss border near Geneva, Switzerland has required considerable innovation. It is also the longest machine ever built. It's very-high-energy particle collisions may yield extraordinary discoveries about the nature of the physical universe. Beyond revealing a new world of unknown particles, the LHC experiments could explain why those particles exist and behave as they do. The LHC experiments could uncover the origins of mass, shed light on dark matter, expose hidden symmetries of the universe, and possibly find extra dimensions of space.

Basically LHC is the baby of USA, but as the years progressed , Germany took over the major role. Britain poured in the money, Switzerland provided the land and French presented their technology. More than 10,000 scientists, engineers and students from 113 nations on six continents contribute to the LHC.

The need for LHC?

We have a beautiful theory of particle physics (The Standard Model) in which many phenomena can be predicted with unprecedented precision but it has withheld all attempts to find flaws in it for decades.

Bibin Babu
S6 ME

The theory has just two problems:
a) It is incomplete
How to explain gravity?
How to explain dark matter + energy?
How to explain mass?

b) It is "wrong"
mathematical inconsistencies at higher energies (i.e. the Standard Model is a low energy approximation)some things just don't feel right

- so many free parameters
- so many different mass scales

For some problems in standard model there are very promising approaches:

1. Build higher energy collider to find new particle that were inaccessible to previous machines
2. Build higher energy collider that will produce Higgs particles if they exist
3. Build higher energy collide to see what happens in that energy region

In our theory, forces are mediated by particles (photon, gluon, W, Z) the mathematics only works if the force particles are massless, but some are not!
This was potentially explained by the Higgs mechanism proposed in the 1960s by theoretician Peter Higgs and others.
Maybe massive particles only appear massive due to some background interaction.

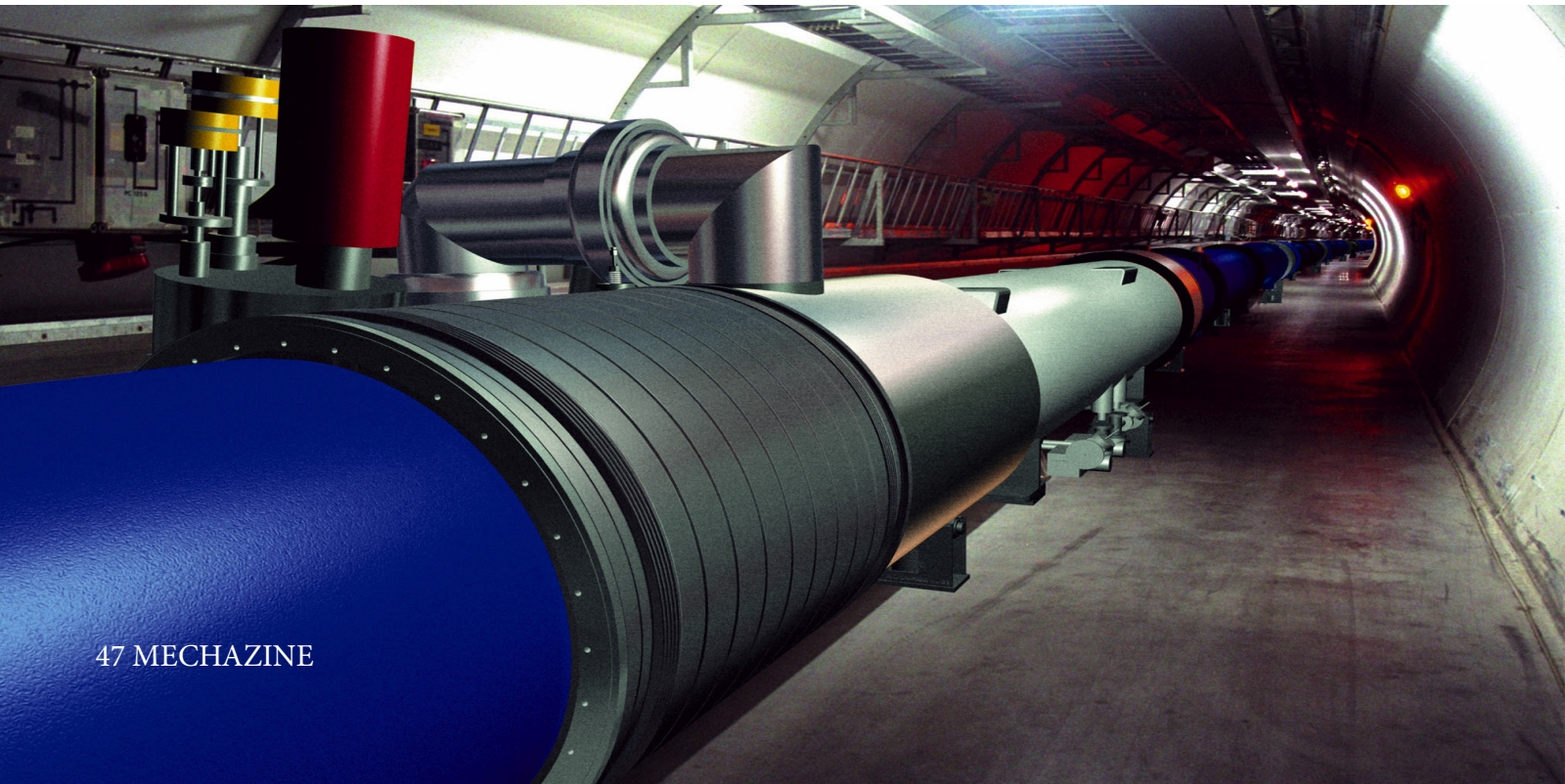
Higgs mechanism: simple analogy

Imagine a room full of physicists discussing quietly. This is like space filled with the Higgs field. When a famous physicist enters the room, people will cluster around him to talk to him. This creates resistance to his movement — he acquires mass, like a particle moving through the Higgs field! The Higgs field is a background field permeating space, the Higgs boson is a field quantum!

If the Higgs mechanism is real, we should see an extra massive particle (the Higgs boson).
We've been looking for it for 40 years! Why haven't we found it?
Massive particles can only be produced with high energy particle colliders (E=mc2), and the energy of previous colliders was obviously not enough!
We don't quite know the mass of the Higgs particle, but the LHC energy is high enough to give us a definite answer!

LHC Hit list

1. We hope to find the Higgs or exclude it once and for all!
2. Understand how forces behave at higher en ergy
3. Find new particles at higher energy
4. Specifically, look for Super symmetry (dou-



ble the number of particles, many theory problems solved)

5. Check whether quarks + leptons might be composite
6. Watch out for tiny extra spatial dimensions
7. Many interesting options!

Recipe for building LHC

OBJECTIVE: smash protons into each other with enormous energy

1. Get a bottle of protons (use hydrogen and ionise it!) use them sparingly: one LHC fill has 2Beams× ≈3000 bunches×1011 protons, i.e. about 1 nanogram, which should circulate ≈ one day
2. Keep your protons in vacuum pipes at all times so your protons don't get disturbed too much LHC: 1/10,000,000,000,000th of atmospheric pressure! (better vacuum than space around the Intl. Space Station)
3. Accelerate your proton beams with electric fields

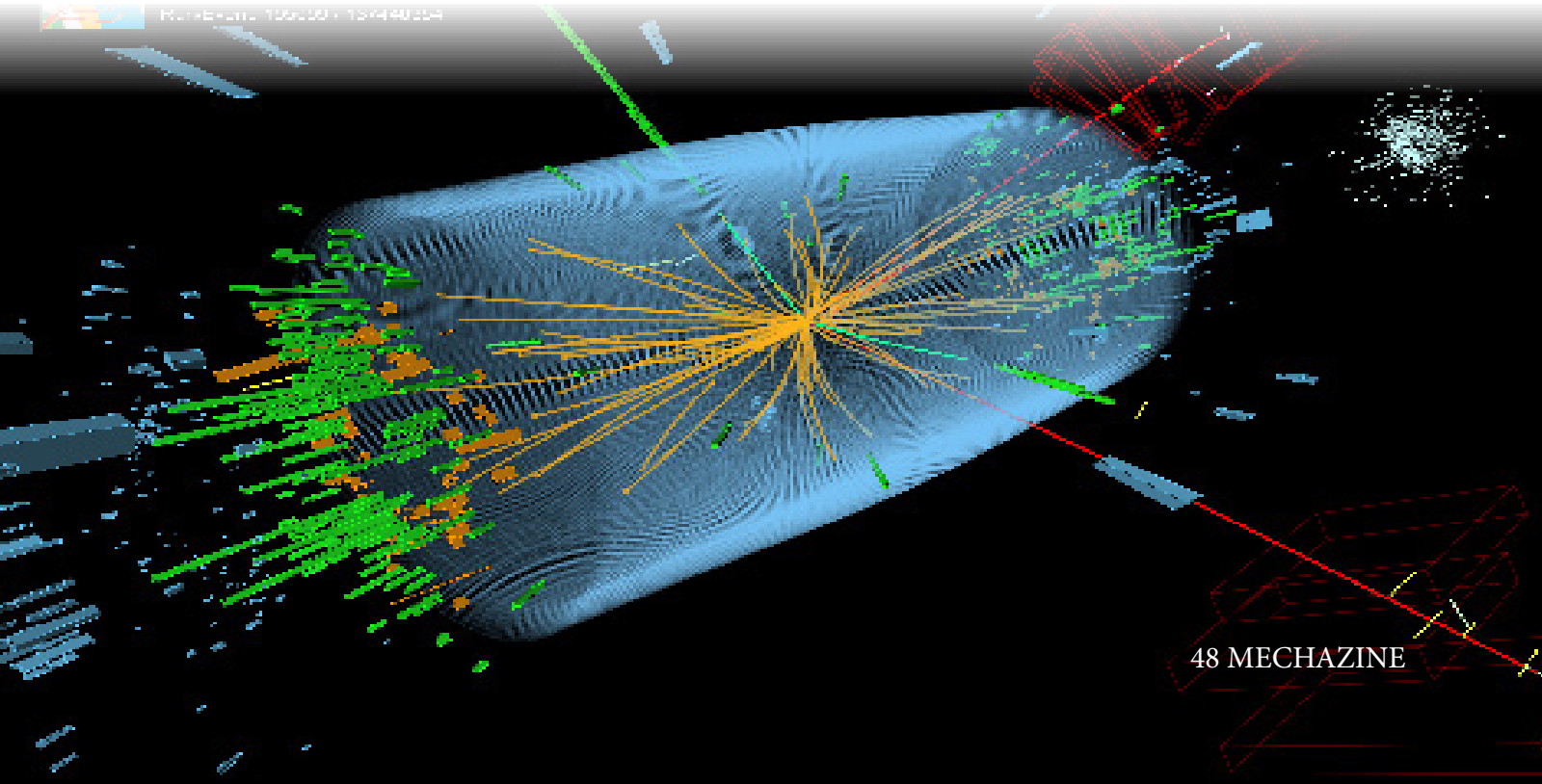
LHC: protons will achieve ≈ speed of light,
total kinetic energy of proton beam=
Eurostar train at≈100 mph!
But we cannot get that much energy from one pass through the accelerating cavities. So we will have to bend beam around with magnetic fields and accelerate it repeatedly
Ever tried to force a 100 mph Eurostar onto a circle using only magnets? Need strong magnets
Need a large circle (9 km diameter!)

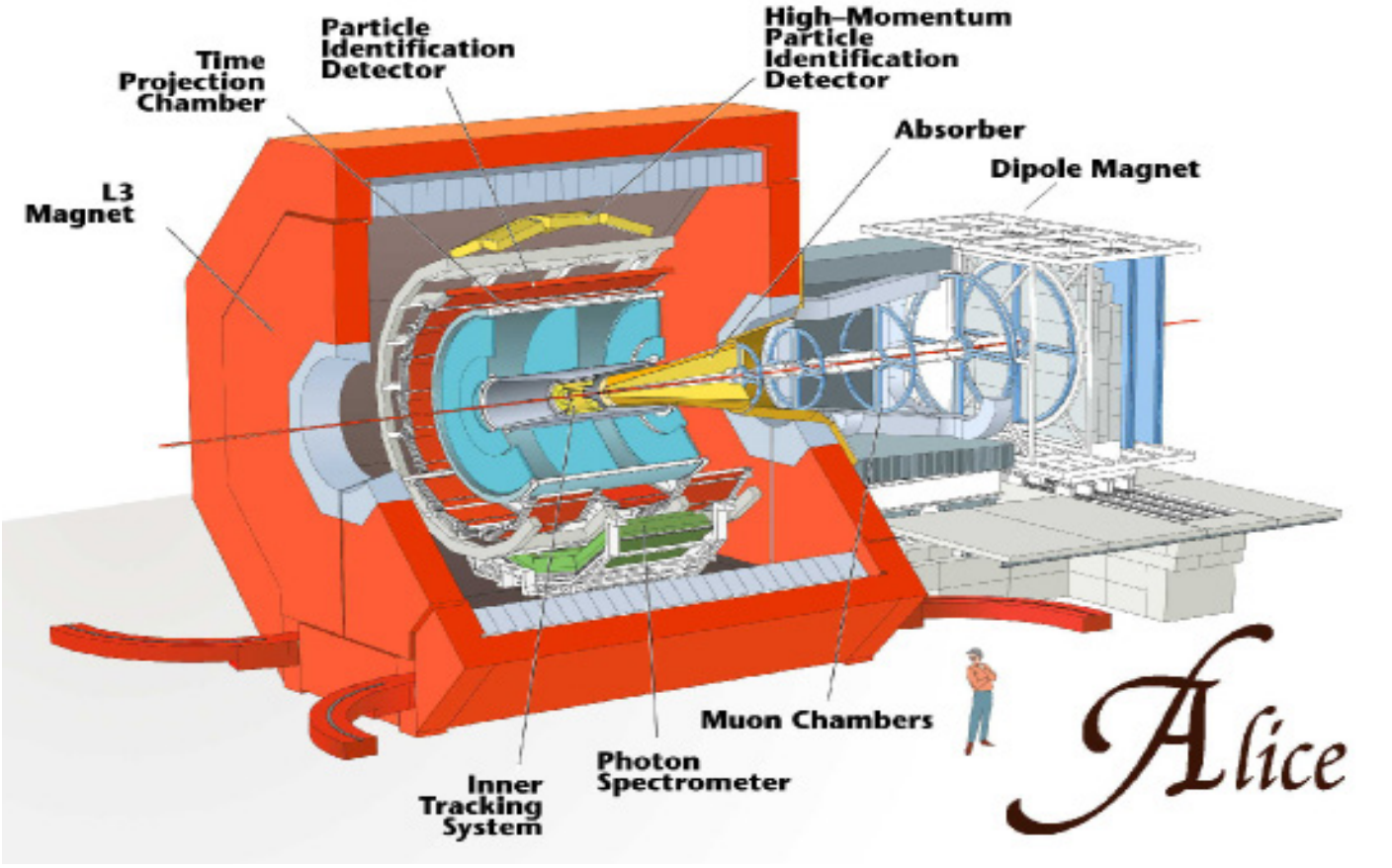
4. Use strong magnets to steer the proton beams strong magnets require huge currents — only manageable with superconducting magnets!

LHC is the largest fridge
on the planet!
6000 tons kept at -271◦ C
corresponding to≈150,000 household fridges
at a temperature colder than the coldest regions of outer space!

Collisions

Two beams circulating in opposite
directions, each with ≈3000 bunches of 1011 protons usually in separate pipes, but crossing each other in 4 places ≈20 collisions every 25 ns! need gazillion collisions because the interesting things might only happen once per billion or trillion collisions!
All the controls for the accelerator, its services and technical infrastructure are housed under one roof at the CERN Control Centre. From here, the beams inside the LHC are made to collide at four locations around the accelerator ring, corresponding to the positions of four particle detectors – ATLAS, CMS, ALICE and LHCb.
ALICE (A Large Ion Collider Experiment) is a





heavy-ion detector on the Large Hadron Collider (LHC) ring. It is designed to study the physics of strongly interacting matter at extreme energy densities, where a phase of matter called quark-gluon plasma forms.

All ordinary matter in today's universe is made up of atoms. Each atom contains a nucleus composed of protons and neutrons (except hydrogen, which has no neutrons), surrounded by a cloud of electrons. Protons and neutrons are in turn made of quarks bound together by other particles called gluons. No quark has ever been observed in isolation: the quarks, as well as the gluons, seem to be bound permanently together and confined inside composite particles, such as protons and neutrons. This is known as confinement.

Collisions in the LHC generate temperatures more than 100,000 times hotter than the centre of the Sun. For part of each year the LHC provides collisions between lead ions, recreating in the laboratory conditions similar to those just after the big bang. Under these extreme conditions, protons and neutrons "melt", freeing the quarks from their bonds with the gluons. This is quark-gluon plasma. The existence of such a phase and its properties are key issues in the theory of quantum chromodynamics (QCD), for understanding the phenomenon of confinement, and for a physics problem called chiral-symmetry restoration. The ALICE collaboration studies the quark-gluon plasma as it expands and cools, observing how it progressively gives rise to the particles that constitute the matter of our universe today.

The ALICE collaboration uses the 10,000-tonne ALICE detector – 26 m long, 16 m high, and 16 m wide – to study quark-gluon plasma. The detector sits in a vast cavern 56 m below ground close to the village of St Genis-Pouilly in France, receiving beams from the LHC.

The collaboration counts more than 1000 scientists from over 100 physics institutes in 30 countries.

The Large Hadron Collider beauty (LHCb) experiment specializes in investigating the slight differences between matter and antimatter by studying a type of particle called the "beauty quark", or "b quark".

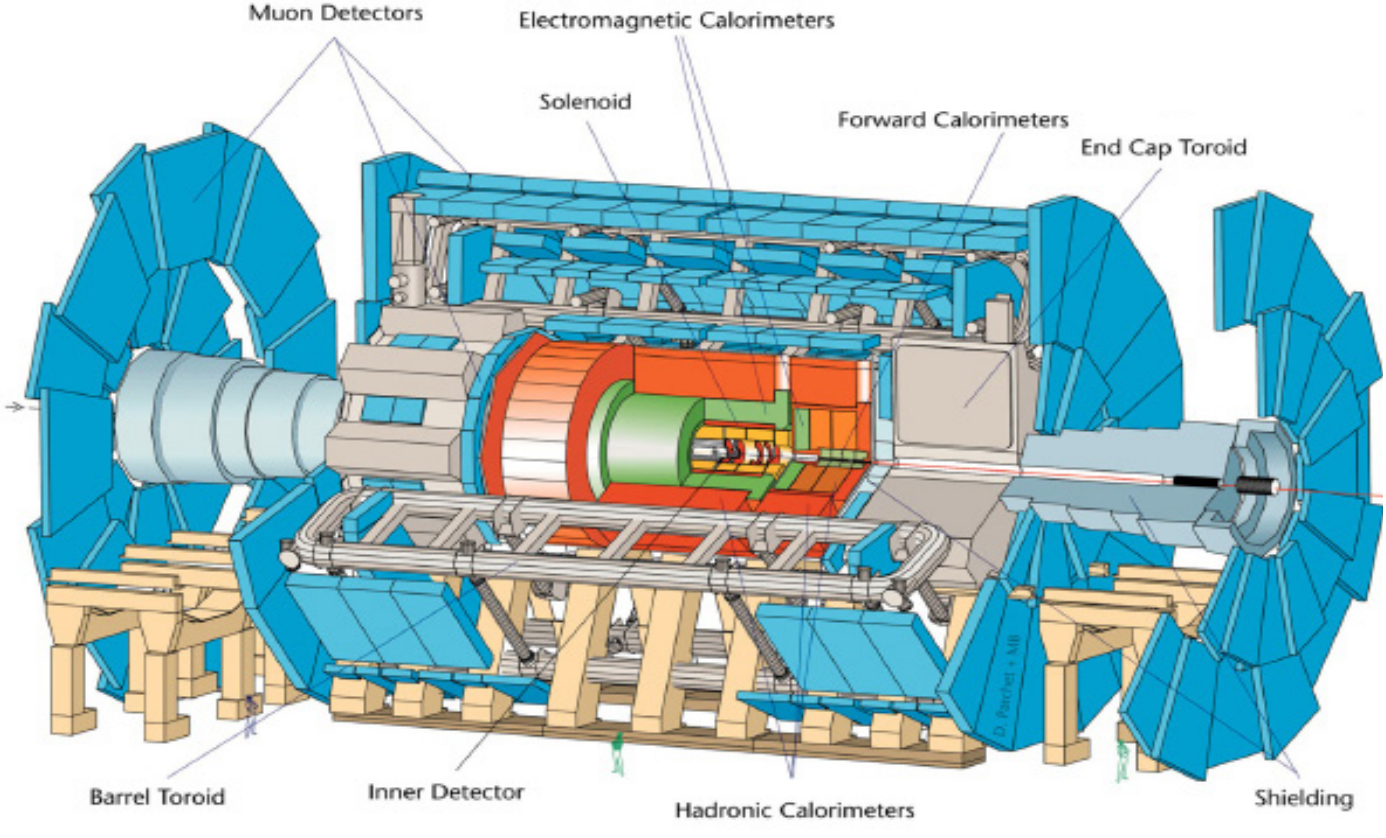
Instead of surrounding the entire collision point with an enclosed detector as do ATLAS and CMS, the LHCb experiment uses a series of subdetectors to detect mainly forward particles - those thrown forwards by the collision in one direction. The first subdetector is mounted close to the col-

lision point, with the others following one behind the other over a length of 20 metres.

An abundance of different types of quark are created by the LHC before they decay quickly into other forms. To catch the b quarks, LHCb has developed sophisticated movable tracking detectors close to the path of the beams circling in the LHC. The 5600-tonne LHCb detector is made up of a forward spectrometer and planar detectors. It is 21 metres long, 10 metres high and 13 metres wide, and sits 100 metres below ground near the village of Ferney-Voltaire, France. About 700 scientists from 66 different institutes and universities make up the LHCb collaboration .

The Compact Muon Solenoid (CMS) is a general-purpose detector at the Large Hadron Collider (LHC). It has a broad physics programme ranging from studying the Standard Model (including the Higgs boson) to searching for extra dimensions and particles that could make up dark matter. Although it has the same scientific goals as the ATLAS experiment, it uses different technical solutions and a different magnet-system design.
The CMS detector is built around a huge solenoid magnet. This takes the form of a cylindrical coil of superconducting cable that generates a field of 4 tesla, about 100,000 times the magnetic field of the Earth. The field is confined by a steel "yoke" that forms the bulk of the detector's 14,000-tonne weight.
An unusual feature of the CMS detector is that instead of being built in-situ like the other giant detectors of the LHC experiments, it was constructed in 15 sections at ground level before being lowered into an underground cavern near Cessy in France and reassembled. The complete detector is 21 metres long, 15 metres wide and 15 metres high.

The CMS experiment is one of the largest international scientific collaborations in history, involving 4300 particle physicists, engineers, technicians, students and support staff from 182 institutes in 42 countries .
ATLAS is one of two general-purpose detectors at the Large Hadron Collider (LHC). It investigates a wide range of physics, from the search for the Higgs boson to extra dimensions and particles that could make up dark matter. Although it has the same scientific goals as the CMS experiment, it uses different technical solutions and a different magnet-system design.

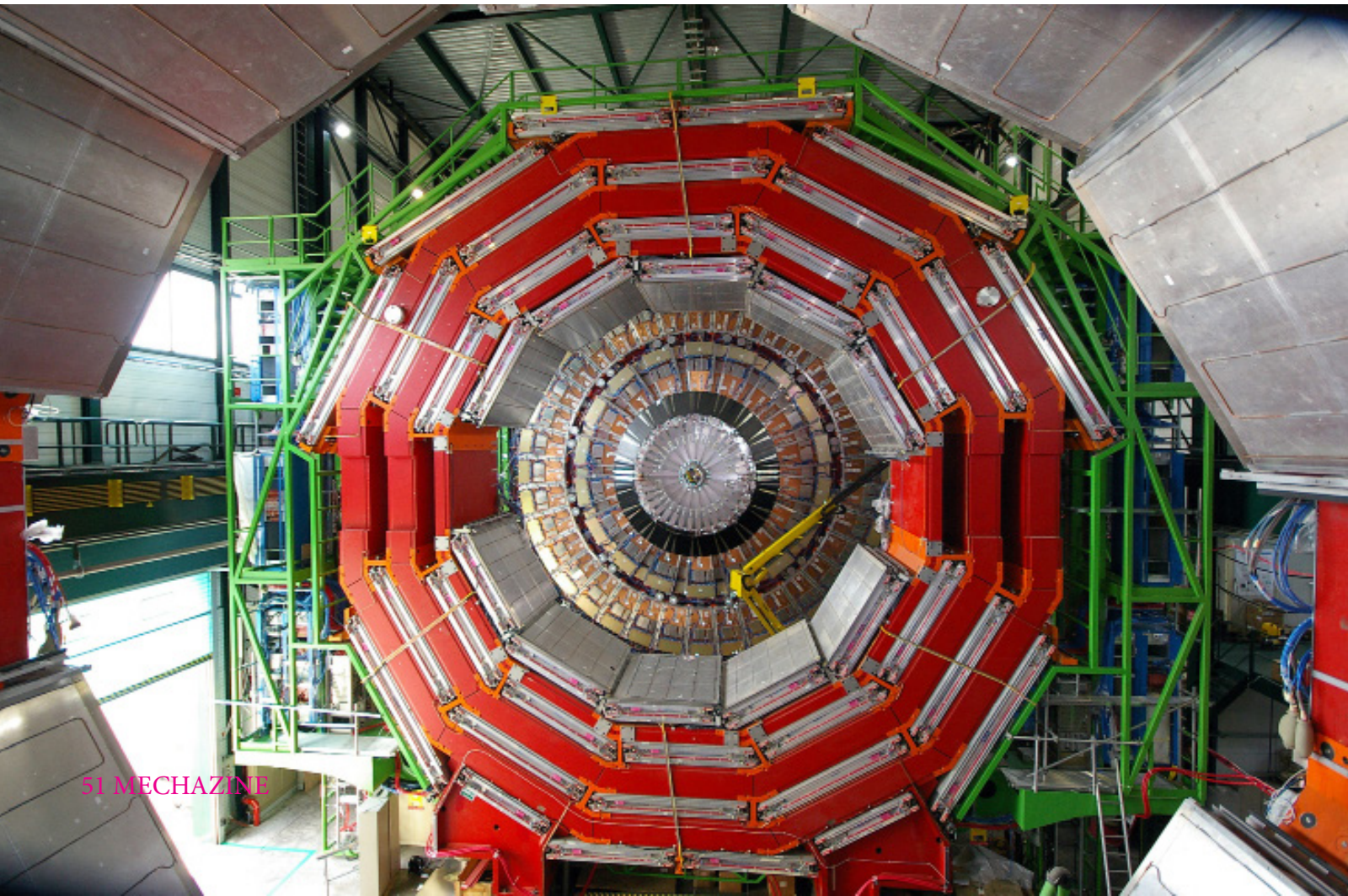


Beams of particles from the LHC collide at the centre of the ATLAS detector making collision debris in the form of new particles, which fly out from the collision point in all directions. Six different detecting subsystems arranged in layers around the collision point record the paths, momentum, and energy of the particles, allowing them to be individually identified. A huge magnet system bends the paths of charged particles so that their momenta can be measured.

The interactions in the ATLAS detectors create an enormous flow of data. To digest the data, ATLAS uses an advanced "trigger" system to tell the detector which events to record and which to ignore. Complex data-acquisition and computing systems are then used to analyse the collision events recorded. At 46 m long, 25 m high and 25 m wide, the 7000-tonne ATLAS detector is the largest volume particle detector ever constructed. It sits in a cavern 100 m below ground near the main CERN site, close to the village of Meyrin in Switzerland. More than 3000 scientists from 174 institutes in 38 countries work on the ATLAS experiment.
Particle physics advances technology on all fronts.

A few specific examples:

1. **Medical applications (MRI, for example)**
2. **Cathode ray tubes (TV sets!)**
3. **Pushing computer technology (e.g. cheap PC farms)**
4. **The world wide web(economic impact? yes!)**
5. **GRID computing & other forms of massive data processing and in long-term who knows what are lhc's possibilities. And also understanding how the Universe works is always a good thing. quantum physics contributed lasers,medicine, machining, DVD players and theory of relativity gave us the GPS...and infinitely many more benefits**



BRAIN TEASERS

ANAND SUNIL
S6 ME

1.In 1932 I was as old as the last two digits of my birth
year. When I mentioned this interesting coincidence to my
grandfather, he surprised me by saying that the same applied to
him too. I thought that impossible...."
"Of course that's impossible," a young woman said.
"Believe me, it's quite possible and grandfather proved it
too. How old was each of us in 1932?

2.Two workers, one old and the other young, live in the same
house and work at the same factory. It takes the young man 20
minutes to walk to the plant. The old man covers the distance in 30
minutes. When will the young worker catch up with the older man
if the latter starts out five minutes before him?

3. In one test-tube you have some hydrochloric acid and
in another the same amourft of water. To prepare a solution you
pour 20 grams of the acid from the first test-tube into the
second. After that you pour two-thirds of the solution in the
second test-tube into the first. There will then be four times as
much fluid in the first as in the second.
How much acid and water was there in the first place?

4. It is very easy to write 24 by using three 8's: 8 + 8 + 8.
Can you do that by using three other identical digits? There is
more than one solution to this problem.

5. Can you write 1 000 by using eight identical digits?
In doing so you may, in addition to digits, use signs of operation.

6. Write 10 with five 9's. Do it in at least two ways.
7. Together with overtime my wages last week were 130
rubles. My basic wage is 100 rubles more than my overtime. How
much do I earn without overtime?
8. The man emptied a box of matches on the table
And divided them into three heaps.
"You aren't going to start a bonfire, are you?" some-one
quipped.
"No, they're for my brain-teaser. Here you are-three uneven
heaps. There are altogether 48 matches. I won't tell how many there
are in each heap. Look well. If I take as many matches from the first
heap as there are in the second and add them to the second, and then

take as many from the second as there are in the third and add them
to the third, and finally take as many from the third as there are in the
first and add them to the first-well, if I do all this, the heaps will all
have the same number of matches. How many were there originally
in each heap?"

9. "It happened at a summer cottage. A household problem,
you might call it. The cottage is shared by three persons-let's call
them X, Y, and Z. It's an old house with an old-fashioned
cooking stove. X put three logs into the stove, Y added five and
Z, who had no firewood, paid them eight kopecks as her share.
How were X and Y to divide the money?"

ANSWERS

1 .At first it may seem that the problem is incorrectly worded, that both grandfather and grandson are of the sameage. We shall soon see that there is nothing wrong with theproblem.It is obvious that the grandson was born in the 20thcentury. Therefore, the first two digits of his birth year are19 (the number of hundreds). The other two digits added tothemselves equal 32. The number therefore is 16: the grandson was born in 1916 and in 1932 he was 16-The grandfather, naturally, was born in the 19th century. Therefore, the first two digits of his birth year are 18. The remaining digits multiplied by 2 must equal 132. The number sought is half of 132, i. e. 66. The grand-father was born in 1866 and in 1932 he was 66.

Thus, in 1932 the grandson and the grandfather were each as old as the last two digits of their birth years.

2 .This problem may be solved in many ways without equations and in different ways.
Here is the first way. In five minutes the young worker covers 1/4 of the way and the old 1/6, i.e. 1/4 —1/6 = = 1/12 less than the young man.
Since the old man was 1/6 of the way ahead of the young worker, the latter would catch up with him after 1/6 4/12 = 2 five-minute intervals, or 10 minutes.The other way is even simpler. To get to the factory the old worker needs 10 minutes more than theyoung one. If he were to leave home 10 minutes earlier,they would both arrive at the place at the same time. Ifthe old worker were to leave only 5 minutes earlier, theyoung man would overhaul him half-way to the factory,i.e. 10 minutes later (since it takes him 20 minutes to cover the whole distance). There are other arithmetical solutions too.

3. Let us suppose that there were x grams of hydrochloric acid in the first test-tube and x grams of water in the second. After the first operation there remained (x — 20) grams of acid in the
first test-tube and (x + 20) grams of acid and water in the second. After the second operation there will remain l/3(x + 20) grams of fluid in the second test-tube and the amount in the first will bex —20+2/3(x+20)=(5x— 20)/3 Since it is known that in the end there was four times less fluid in . the first as in the second, we shall have 4/3(x+20)=(5x— 20)/3 hence x=100, i.e. there were 100 grams in each graduate.

4. Here are two solutions:
22+2=42: 33 -3=24.

5. 888 + 88 + 8 + 8 + 8 = 1000. There are several other solutions.

6. The two ways are as follows:
9+(99/99)=10
(99/9)-(/9)=10
If you know algebra, you will probably add several other
solutions. For instance:
(9+99/)9/9=10 99
9+999-/9 =10

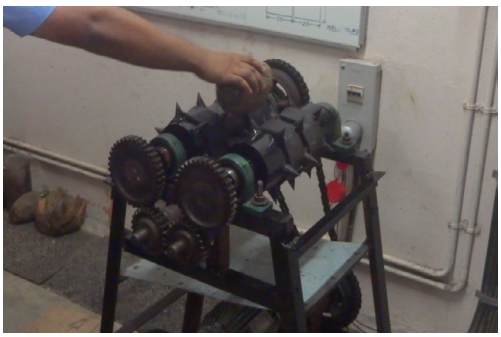
7. Many say 100, without even stopping to think. That iswrong, for then the basic wage would be only 70 rubles more than
overtime and not 100.
Here is how the problem should be solved. We know thatif we add 100 rubles to overtime we get the basic wage.
Therefore, if we add 100 rubles to 130 rubles we have two basic
wages. But 130 + 100 = 230. That means two basic wages equal
230 rubles. Hence, the basic wage alone, without overtime,
amounts to 115 rubles and overtime to 15 rubles.
Let us verify: 115 — 15 = 100. And that is as the problem has it.

8. This problem is solved from the end. Let us proceed
from the fact that, after all the transpositions, the number of
matches in each heap is the same. Since the total number of
matches (48) has not changed in the process, it follows that
there were 16 iri each heap. And so, what we have in the endis:
First Heap Second Heap Third Heap
16 16 16
Immediately before that we had added to the first heap as many matches as there were in it, i.e. we had doubled
the number. Thus, before that final trans¬position, there
were only 8 matches in the first heap. In the third heap, from
which we took these 8 matches, there were:
16 + 8 = 24
Now we have the following numbers:
First Heap Second Heap Third Heap
8 16 24
Further, we know that from the second heap we took as many matches as there were in the third heap. That means
24 was double the original number. This shows us* howmany matches we had in each heap
after the first transposition:
First Heap Second Heap Third Heap
8 16+12-28 12
It is clear now that before the first transposition (i. e. before we took as many matches from the first heap as there were in the second and added them to the second) the number of matches in each
heap was:
First Heap Second Heap Third Heap
22 14 12

9. It is not right to think, as many do, that eight kopecks were paid for eight logs, a kopeck for a log. Themoney was paid for one-third of eight logs because the firethey produced was used equally by all three. Consequently,the eight logs were estimated to be worth 8 x 3, i. e. 24kopecks, and the price of a log was therefore three kopecks.
It is now easy to see how much was due to each. Y's five logs were worth 15 kopecks and since she had used 8 kopecks worth of fire, she would have to receive 15 — 8,
i. e. 7 kopecks. X would have to receive 9 kopecks, but ifyou subtracted the 8 kopecks due from her for using the stove, you would see that she had to receive
9— 8, i. e. 1 kopeck.

FINAL YEAR PROJECTS

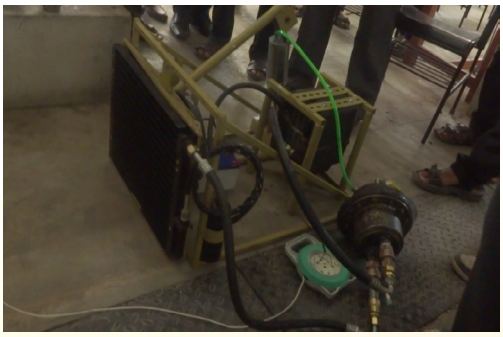
HYDROGEN FUEL ENHANCEMENT



COCONUT DEHUSKER

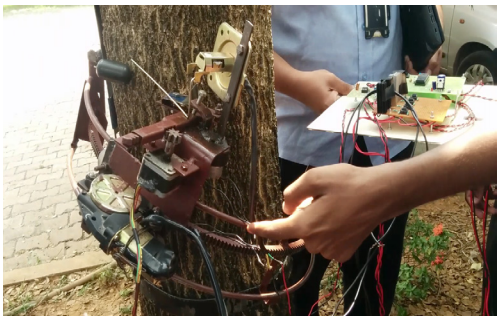
BIOGAS AS AN ALTERNATE FUEL IN 2 STROKE SI ENGINE

FABRICATION OF PULSE JET ENGINE AND INTEGRATING IT WITH A GOKART



WORKING OF AN AIR CONDITIONING UNIT USING DAMPING EFFECT OF SHOCK ABSORBER

COMPRESSED AIR VEHICLE

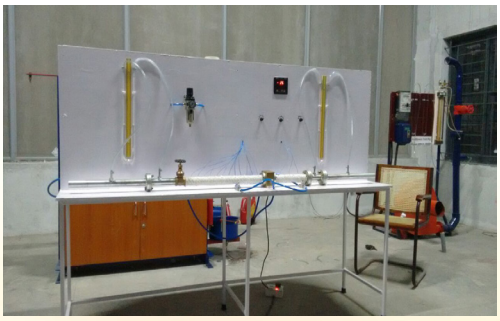


AUTOMATIC RUBBER TAPPING MACHINE

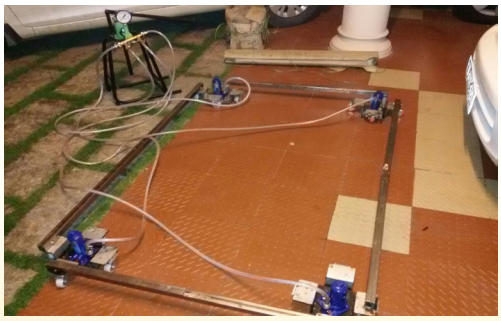
DESIGN OF HELICAL COIL DEHUMIDIFIER FOR GRAVITY DRIVEN SOLAR DISTILATION UNIT

STAIR CLIMBING WHEEL CHAIR

SIMULATION OF AN AUTOMOBILE FOR A COMMON MAN



FABRICATION AND ANALYSIS OF VORTEX TUBE REFRIGERATION SYSYTEM



PORTABLE VEHICLE MOVING SYSTEM

Department of Mechanical Engineering

The Department of Mechanical Engineering was established in the year 2011 with an annual intake of 60 students. The intake was increased to 120 students in the year 2014. Mr. Manoj G.Tharian heads the Department, which at present has 17 faculty members, maintaining a Staff - Student ratio of 14.8. The Department has a dedicated faculty of highly qualified and experienced members in all streams of Mechanical Engineering including 2 Professors, 1 Associate Professor and 14 Assistant Professors. The faculty includes 2 PhD holders and 1 undergoing PhD programme.

VISION

To evolve into a centre of excellence in mechanical engineering education with excellent ambience to foster creative research for the betterment of mankind.

MISSION

To impart state-of-the-art knowledge to students in mechanical engineering to make them professionals with creative minds and practical skills with social commitment.

BRANCH ASSOCIATION

The branch association 'REAL MECHANICA' was formed in the year 2013. The association is headed by the Association secretary (elected head) and guided by two faculty advisers. It regularly conducts technical events at Techkshethra and Abhyantriki. It also publishes a yearly technical magazine by the name 'MECHAZINE' in which students contribute articles about recent technical developments in mechanical engineering.

Behind MECHAZINE 2015

Vineeth Krishna
Assistant professor

Jithin P Narayanan
Assistant professor

Jithin Jose
S6 ME

Joel Augustine
S6 ME

2015 Mechazine

Mechazine 2015 Volume I

Real Mechanica

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